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SUBJECT.

Experimental Farm, Nagpur—1890-91.

J. B. FULLER, Esq., C. S.,

COMMISSIONER OF SETTLEMENTS AND AGRICULTURE,

Central Provinces,

Nagpur,

To

THE SECY. TO THE CHIEF COMMISSIONER,

Central Provinces.

Dated Nagpur, the 15th October 1891.

SIR,

I have the honour to submit the annual Report on the working of the Nagpur Experimental Farm during the year 1890-91.

2. The value of the Farm has been very greatly increased by a careful examination and classification of its fields according as they are or are not fitted for experimental purposes. A record which has been systematically maintained of the treatment and produce of each field during the six years which have passed since the Farm was established, was of course of great assistance in making this classification. The fields fitted for experiment have been divided off into plots, the practical similarity of which can be guaranteed, and in future each experiment will be made within the limits of a single field and under therefore similar conditions. Moreover, a scheme of experiments has been laid down for the greater part of the experimental area (leaving, however, some plots for new experiments to be initiated hereafter), and each fact to be enquired into will in future be investigated by a continuous series of trials instead of being made the subject of disconnected experiments in various parts of the Farm.

In making these improvements, I am largely indebted to suggestions received from Dr. Voelcker when he visited the Farm last year.

3. A further improvement which has been made is the more exact registration of the amount of labour used in cultivation, which is now separately recorded *for each plot* under experiment. The outlay per acre as shown, is obtained by multiplying the amount of labour or manure *actually used* in each case by certain average rates, details of which are given in an Appendix. These rates are those at which labour and manure can be obtained at Nagpur and are far higher than village rates. They make the cost of cultivation much larger than it is to an ordinary cultivator.

4. The year was characterized by abnormally heavy rainfall during the cold weather, as well as the monsoon months. October was unusually dry, but an extraordinarily heavy fall occurred in the first half of November, and as much as 5¼ inches were registered during the months (December to March) when spring crops were on the ground,—the average fall during this period being only 1½ inch. The principal kharif crop of the Farm is cotton, which prefers a light rainfall. The season was therefore not favourable, but owing (I think) to the fact that the seed was got in early, so that the plants had made a good start before heavy rain overtook them, the injury suffered was less than might have been anticipated. The early part of the cold weather was exactly as could

be desired for the wheat and linseed crops, but the continuance of damp weather ultimately caused much damage through rust. But notwithstanding this the wheat crop was the best that has been reaped for years past.

5. The experiments with cotton comprised two of much interest,—one to test the effect of green soiling with hemp in the previous year, the other to compare the produce of different varieties of cotton.

The effect of green soiling is shown in Table I of the report. Field No 14 was manured during the rains of 1889 by the ploughing in of a crop of san-hemp (*Crotalarix juncea*) grown on it. Wheat was sown during the following cold season, but the hemp gave no increase in the wheat crop, owing to the failure of the cold weather rains. But it produced a most striking effect on the cotton crop following the wheat, increasing the outturn by Rs. 10 and raising the profit to Rs. 21 per acre. This result is corroborated by the excellent out-turns yielded by certain varieties of cotton grown in fields Nos. 15 and 22 which had also been green soiled in 1889 (see Table II). Comparing the out-turns with those gathered on other fields, it is difficult to avoid the conclusion that the green soiling at the very least doubled the produce.

The cost of green soiling with san-hemp (at the high rates used for calculation) is Rs. 9-8-0 per acre. In a year of good cold-weather rainfall, or with irrigation—at least Rs. 5* of this would be recovered from the increase in a crop of wheat grown in the following rabi season, and the cultivation of cotton after the wheat promises a handsome profit. This rotation will be made the subject of a permanent experiment.

* See Tables VII and VIII, Plots VII and VIII.

6. Trial was made of fifteen different varieties of cotton (Table II), two of which were American but acclimatized. The most interesting of the results obtained is the justification of the ryot in his preference for growing short stapled *jari* cotton in place of the long stapled *bani*, which exporters and Mill-owners would like to force on him. The value of jari cotton at present rates is 37 per cent. below that of bani cotton, but this difference is more than counterbalanced by its larger out-turn, the larger proportion it gives of lint to seed, and its ability to stand unfavourable weather. The results obtained in Field No. 22,* show clearly that unless there is a considerable fall in the relative price of jari cotton, it is the most profitable variety to cultivate.

* Table II, Experiment No. 2.

Of the American varieties, New Orleans (from seed acclimatized at Saharanpur) and Upland Georgian acclimatized on the Farm show the best results. The latter gave much the smaller out-turn, but it was grown in a different series, and the out-turns are not comparable *inter se*. Both deserve further trial. A variety obtained from the Nimar district, somewhat similar to *bani*, also promises well.

7. The preparation of cotton seed for sowing by the use of sulphuric acid to dissolve the adherent fibres, which gave very promising results in 1889, compared unfavourably during the year under report with the method in ordinary use. The discrepancy may very probably be due to differences in the character of the season. The monsoon of 1889 was one of light rainfall and it is quite possible that it is only in such a year that the use of sulphuric acid improves the crop. This is of course merely a speculation; but it is borne out by the growth of a cotton crop now on the ground. During the earlier part of the rains the portion treated with acid was markedly the best. But as the season advanced and developed into one of abnormally heavy rain-fall, conditions became reversed and this portion is now inferior to the rest.

8. The heavy rain-fall of the cold-weather months was of course calculated to bring out the effect of manure on the wheat crop and the results obtained on the permanent manure series of plots (Table VII) deserve particular notice. The unmanured plot yielded at the rate of 515 lbs. grain

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per acre. The produce was raised to 937 lbs by the use of dung and to 1227 lbs, by the use of saltpetre. Bone-dust added comparatively little, and it is clear that such effect as it produces is mainly in virtue of the nitrogen not of the phosphoric acid it contains. The addition of bone-dust to dung in no way adds to the produce [see in particular for this, plots IV and V in Table VIII.] The use of dung at the high rate charged for it raised the profits per acre from Rs. 7 to Rs. 12, the use of saltpetre resulted in a loss owing to the very high price which it commands in Nagpur—Rs. 10 per maund. If the experiments of the past seven years have shown anything plainly it is that saltpetre is one of the most potent manures available and in the interests of agriculture it is much to be desired that all restrictions on its manufacture should be withdrawn and its cost be lowered by all means possible.

9. I noticed when submitting last year's report that the effect of manures on the spring crops so greatly depended on the presence of moisture for dissolving them, that in years of short cold weather rain-fall their use might often result in loss, and this seemed to explain the indifference to manure shown by the people in large wheat growing districts in these Provinces. The use of irrigation would of course change matters entirely, as it would ensure that the manures had full opportunity of exerting such powers as they possessed. It has accordingly been determined to irrigate the second series of manure plots (Series B) and to compare its results with those gained on Series A without irrigation.

The season was of course an unfavourable one for irrigation experiments but the figures given in Table VIII show that the single watering given made a very great difference in the produce. The produce of unmanured land rose from 515 lbs. to 802 lbs, that of land manured with dung from 937 lbs to 1037 lbs, and that of land manured with saltpetre from 1227 lbs to 1532 lbs. The amount of water given per acre was not determined, but its cost was approximately Rs. 6-12-9 which was much more than covered by the increase in produce.

A fact contrary to what appeared probable was that the use of irrigation did not render the crop more liable to rust, although it so happened that heavy rain fell immediately after watering was given.

10. Green soiling with san-hemp added 245 lbs. to the produce per acre without irrigation, but only 123 lbs. when irrigation was used. In the former case it exactly covered its cost, in the latter case there is a loss which would however be recovered were a cotton crop to follow. An interesting experiment was tried in green soiling with the common yellow-flowered weed called (incorrectly) wild indigo (*Cassia auriculata*). Its use added (Table X Experiment No. 1) 222 lbs. of grain to the produce, which more than covered the extra outlay.

11. The fields which were embanked some years ago for the growth of wheat in the method followed in the Jubbulpore district gave excellent results. No unembanked field is available in their immediate vicinity for comparison but their outturns have been contrasted (Table XI) with those of two of the best unembanked fields on the Farm. Embankment with manure added Rs. 10 to the produce: without manure it added Rs. 4-8-0. In the former case the increase was very remunerative. The embankment of this land cost Rs. 53-8-0 per acre.

12. The experiments to determine the effect of deep tillage, of thin sowing and of seed selection gave inconclusive results. The pedigree wheat suffered more from rust than any other crop and its outturn was disappointing. The linseed crop was also so much damaged by fungoid disease as to be useless for experimental purposes.

13. A fact worth special notice in connection with agricultural machinery is the continued success of the hand threshing machine manufactured by Messrs. Mayfürth and Company of Frankfort; with 5 men and 2 women it can thresh wheat at the low rate of 5·6 pies per maund,

14. The condition of the Agricultural Class is not quite so hopeful as it appeared to be last year. The students who passed out qualified last March showed in their examination that the course of instruction is sound and that they had profited by it. But this year's entries are fewer than before, and there have been signs in this falling off and in the behaviour of the students of a distrust on the part of the educated classes of the policy of Government in offering young men inducements to undergo a training in agriculture instead of pursuing their education in Arts.

15. Mr. Mahaluxmivala's management of the Farm and Class has continued to be very satisfactory. His report is the most elaborate of any as yet drawn up.

I have the honour to be,

Sir,

Your most obedient Servant,

J. B. FULLER,

Commr. of Settlements and Agriculture,

Central Provinces.

No. 598.

SUBJECT.

Report on the working of the Experimental Farm, Nagpur, for the year 1890-91.

FROM

THE SUPERINTENDENT,

EXPERIMENTAL FARM,

Nagpur,

To

J. B. FULLER, ESQ., C. S.,

COMMISSIONER OF SETTLEMENTS AND AGRICULTURE,

Central Provinces.

Dated Nagpur, the 14th September 1891.

SIR,

I have the honour to submit the annual Report on the working of the Experimental Farm, Nagpur, for the year ending the 31st March 1891.

2. During the year under report a careful examination has been made of the Farm lands with reference to their suitability for experimental purposes, and fields have been sub-divided into plots so as to afford more scope for the contrasting of results obtained from land which was known to be of uniform quality.

A plan of the Farm as newly laid out is attached to this report. It consists of 70 fields in all, besides the Permanent Manure Series A, B and C, and covers 111·11 acres, of which 16·38 acres have been appropriated to a series of permanent experiments, 12·98 acres to temporary experiments, while 41·66 acres form the non-experimental area of the Farm—the fields in this area from their poverty or inequality being unsuited for experimental purposes. The remaining 40·09 acres are accounted for by roads, buildings and waste land, &c. Besides the above, a block of 19·25 acres has been lately annexed to the Farm (coloured purple in the plan) divided into 77 quarter acre plots, which forms the practical instruction ground for the students of the Agricultural Class. Field No. 70 has been also given to the students for practical gardening.

3. The programme of experiments now laid down comprises two classes of experiments—(1) permanent and (2) temporary.

A Schedule of the permanent experiments initiated up to date is annexed to this report (marked D). They include experiments in regard to—

1. Tillage.
2. Embanking fields.
3. Mixtures of crops.
4. Rotation.
5. Different kinds of manures.

The fields appropriated to these experiments are coloured red in the map.

The temporary experiments during the year under report (area coloured yellow in the map) include trials of—

1. Different varieties of crops.
2. Thick and thin sowing.
3. Selected against ordinary seed.
4. Top dressing with saltpetre.
5. Pickled seed.

A.—CHARACTER OF THE SEASON.

4. The quantity and distribution of the rain-fall during the year under report are shown in the table which follows. It will be observed that the fall during the year was greater by 9·56 inches than the average of the 16 years preceding:—

Month.	Year under report.		Average of 16 years preceding.	Month.	Year under report.		Average of 16 years preceding.
	Number of rainy days.	Rain in inches.			Number of rainy days.	Rain in inches.	
				Brought forward ...	59	51·20	43·88
April ... 1st half ...	...	0·04	0·11	October. 1st half ...	...	0·05	1·71
April ... 2nd half ...	1	0·15	0·26	October. 2nd half ...	...	0·01	1·52
May ... 1st half ...	...	0·00	0·31	November. 1st half ...	2	2·53	6·55
May ... 2nd half ...	...	0·04	0·30	November. 2nd half ...	...	0·00	0·27
June ... 1st half ...	5	2·52	3·34	December. 1st half ...	2	0·99	0·12
June ... 2nd half ..	6	7·15	5·12	December. 2nd half ...	2	1·63	0·31
July ... 1st half ...	8	9·31	7·63	January. 1st half ...	...	0·00	0·41
July ... 2nd half ..	9	6·35	6·83	January. 2nd half ...	2	1·17	0·16
August... 1st half ...	7	5·06	6·99	February 1st half ...	1	0·15	0·10
August... 2nd half ...	6	6·66	4·22	February 2nd half ...	1	0·48	0·26
September. 1st half ...	8	4·95	4·32	March ... 1st half ...	2	0·67	0·09
September. 2nd half ...	9	8·97	4·45	March ... 2nd half ...	1	0·19	0·13
Carried over ...	59	51·20	43·88	Total ...	72	59·07	49·51

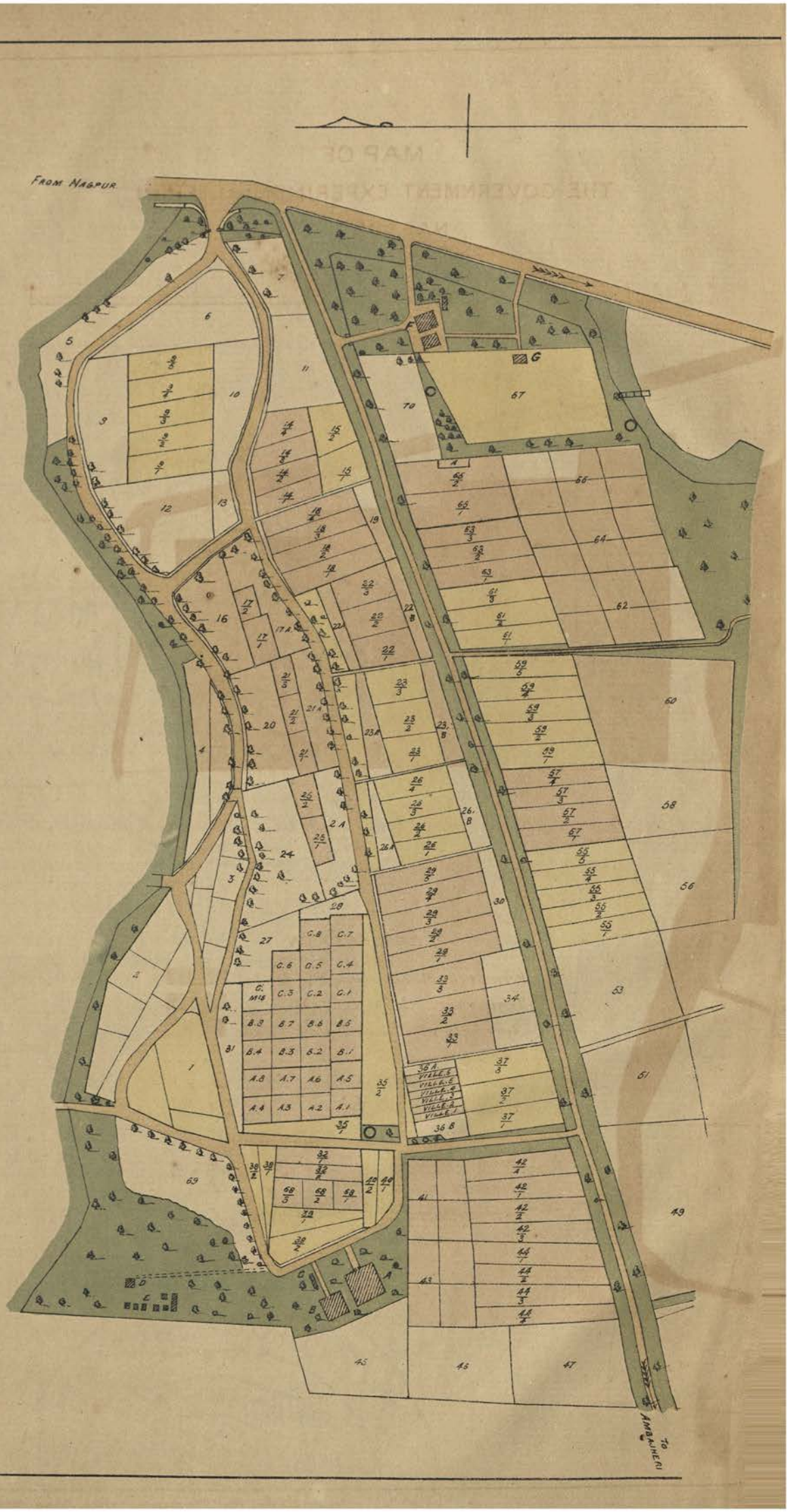
NOTE.—A rainy day is taken as one on which there was a fall of not less than 10 cents.

5. The kharif crops germinated well, but continuous rain in July and August prevented weeding and checked their growth. An opportune break afterwards was very beneficial and the crops continued making good growth in seasonable weather. In the beginning of October it was noticed that a considerable number of cotton plants had their stems bored by an insect which Mr. E. C. Cotes of the Indian Museum, Calcutta, pronounced to be the larva of a small Buprestid beetle. It is remarkable that only the country varieties of cotton were attacked by the insects, the American varieties being almost entirely free from them. In the beginning of November, juar was attacked to some extent with smut. The crops again suffered from cloudy weather at the end of November which did much damage, especially by bringing on attacks of insects on *tur* (*Cajanus sativus*) and other crops which were in flower at the time. Further damage was done to juar and to cotton when the bolls had burst by the rain which followed the cloudy weather. On the whole the season was not favourable to the kharif crops, and they yielded a poor outturn.

6. The rabi sowings were also made under very favourable conditions, and the crops continued to thrive well and promised an harvest such as has not been reaped for many years past. But the cloudy weather at the end of November did much damage to linseed which was in flower. Rabi *til* (Sesamum Indicum) was also attacked by caterpillars which Mr. Cotes identified as those of a Bombycid moth, probably *Spilosoma suffusa*. The wheat crop did not suffer at that time and promised remarkably well;—indeed there seemed every chance of gathering a splendid harvest. But a recurrence of cloudy and rainy weather in January induced an attack of rust which lowered the outturns very greatly, particularly in the case of the best fields—and the wheat harvest, though above the average, fell considerably short of expectation.

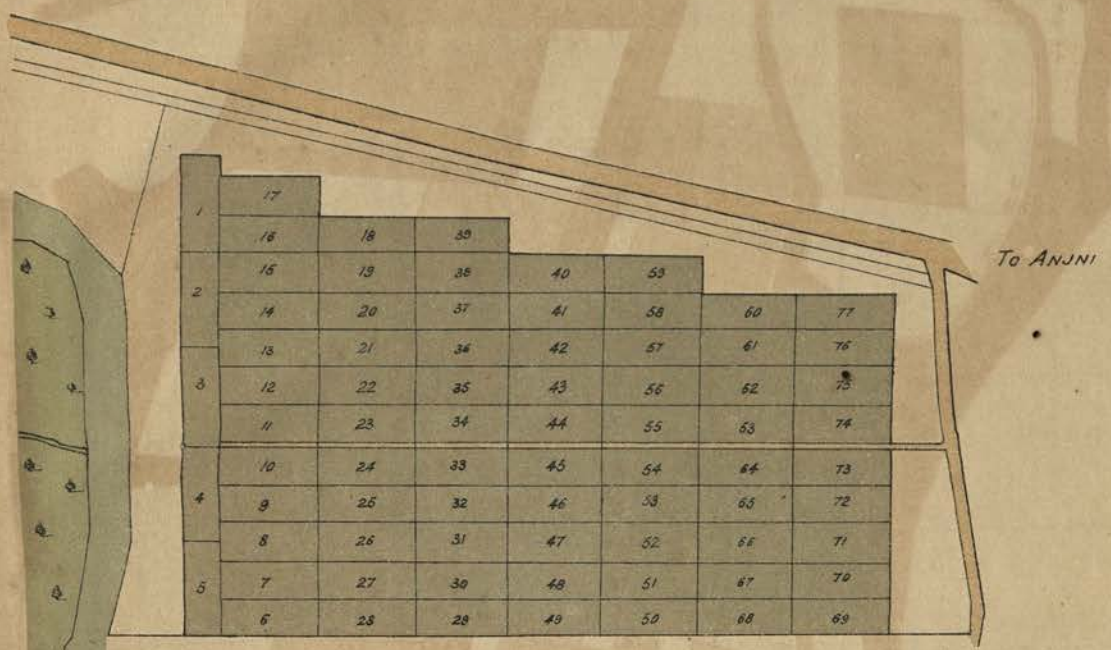
7. Before detailing the results of the year's experiments, it should be explained that in the case of each plot the cost of cultivation and the value of the produce have been calculated and recorded and are shown in the tables which follow. The expenditure on labour has been calculated by multiplying the time actually taken *for each operation on each plot* by the amount of labour employed, valued at the following rates—

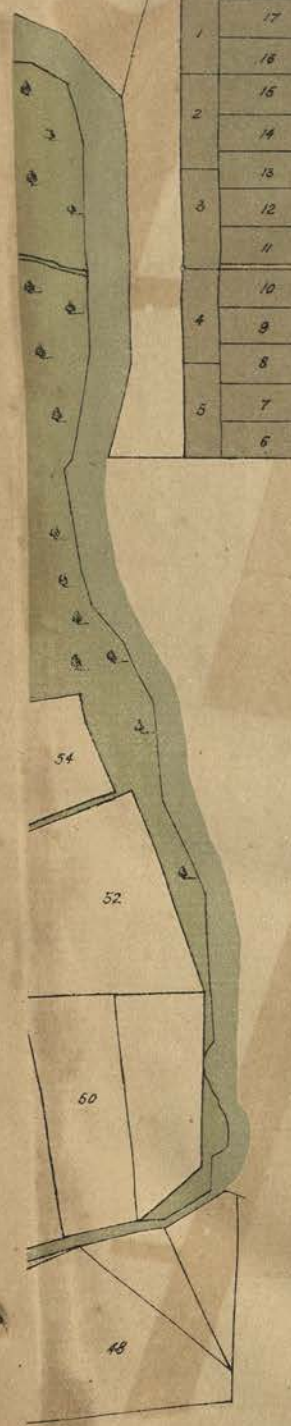
—a pair of bullocks ... 12 annas.
—a male labourer ... 3 annas.
—a female labourer ... 1½ annas.
—a child ... 1 anna.


FROM NAGPUR
TO AMBAJHERI

MAP OF
THE GOVERNMENT EXPERIMENTAL FARM
NAGPUR C.P.

Scale 5 Chains = 1 Inch





EXPLANATION

Permanent Experiments Fields	
Temporary Do. Do.	
Agricultural Class Students' plots	
Non-experimental Fields	
Farm Office & Godowns	A
Cattle shed	B
Silos	C
Workshop	D
Manure pits	E
Agricultural Class Buildings	F
Veterinary Dispensary	G

Drawn & Litho. Govt Photozinco Office, Poona 1931.

Annexure A gives the *average* cost of each class of operation per acre as deduced from the accounts of all plots on the Farm. The rates adopted for valuing labour are those at which it can actually be obtained in Nagpur, which are of course in many cases very high. To give an instance or two:—The hire of a pair of bullocks is calculated at 12 annas per day, which is the rate at which a strong pair can be had at the busy time of the season. The actual cost of feeding with purchased food and tending a large sized pair on the Farm is about 8 annas per day, and including interest on outlay and depreciation about 10 annas. At the Bhadgaon and Cawnpore Farms the rates charged are 5 and 9 annas per pair per day respectively. Again the cost of cattle dung is calculated at Rs. 10 per 160 maunds, which is the actual rate at which it can be bought in Nagpur where there is a great demand for it for orange gardens, &c. On the Bhadgaon and Cawnpore Farms the rates are Rs. 1-14-6 and Rs. 4-12-9 per 160 maunds respectively.

Annexure B gives the rates at which the produce has been valued. They are those at which the produce was or could be sold.

B.—KHARIF EXPERIMENTS.

8. In the Kharif season experiments were made with cotton and juar (Sorghum vulgare). The experiments with cotton included trials of (1) various manures, (2) different varieties of cotton, and (3) growing cotton as a mixed instead of as a sole crop.

The juar experiments were concerned with (1) the effect of different manures and (2) the relative value of different varieties.

9. COTTON—(1) *Manures.* The following table gives the results obtained in two fields—Nos. 14 and 44. In the first field the effect was tested of green soiling with hemp *in the previous year*, a crop of wheat having been gathered in the interim. The second field shows the effects of different manures applied in the season of experiment:—

TABLE I.—Cotton; manures.

Serial number of experiment.	Number of field.	Number of sub-plot.	Area	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
				Crop.	Manure.	Crop.	Manure per acre.	Lint.	Seed.	Actual.		Percentage.					
										Lint.	Seed.	Lint.	Seed.				
			Acs.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
	14	1	0·19	Wheat.	*Nil.*	Cotton Upland Georgian.	*Nil.*	89	205	...	...	...	...	11 6 10	*Nil.*	22 12 6	
		2	0·19	do.	do.	do.	do.	93	214					11 10 5	do.	23 12 8	Average outturn of plots 3 and 4 is compared with that of plots 1 and 2.
		3	0·19	do.	Green soiling with San (hemp)	do.	do.	127	298	+39	+84	+43	+40	12 9 3	do.	32 9 1	
		4	0·19	do.	do.	do.	do.	132	290					12 3 2	do.	33 9 11	
2	44	1	0·38	Wheat	Dung.	Cotton Nagpur Jari.	Stall-dung (160 mds.)	46	69	+ 4	+ 1	+ 9	+ 1	7 2 6	11 8 3	7 6 6	A poor field.
		2	0·38	do.	do.	do.	Box-dung (160 mds.)	59	85	+17	+20	+40	+29	7 0 6	11 8 3	9 8 1	
		3	0·38	do.	do.	do.	*Nil.*	42	68	...	...	...	...	7 9 1	Nil.	6 14 1	
		4	0·38	do.	do.	do.	Bone-dust (360 lbs.)	43	69	+ 1	+ 1	+ 2	+ 1	6 10 2	4 12 0	6 15 5	

The results of Experiment No. 1 are extremely favourable to the green soiling. Nothing has been added to the cost of cultivation on its account, as it was effected for the preceding crop of wheat. But calculating its cost at the full rate (Rs. 9-8-6) there is still an increase in profit. An inspection of the crop left no doubt as to the effect of the hemp. The limits of the plots treated with it were marked by an immediate and striking change in the colour and height of the crop.

The outturns of Experiment No. 2 are exceedingly small, due to the fact that the field is a poor one. The results, so far as they go, show that bone dust added little or nothing to the outturn; that ordinary cattle dung made but a small difference, and that cattle dung collected on the "box" system, under which the urine is not lost, increased the outturn by only 9 per cent. I think that the results should be rejected. The field was water-logged and could not be weeded at the proper time.

In Experiment No. 2 each plot was cross divided and sown partly with seed treated with sulphuric acid, and partly with seed prepared in the ordinary way by being rubbed with dung.

No. of plot.	Manure.	Seed how prepared.	Outturn per acre.	
			Lint.	Seed.
			lbs.	lbs.
1	Stall dung ...	with acid ...	35	55
		with dung ...	56	84
2	Box dung ...	with acid ...	54	82
		with dung ...	63	94
3	*Nil* ...	with acid ...	36	62
		with dung ...	48	74
4	Bone dust ...	with acid ...	42	68
		with dung ...	43	70

The use of acid has throughout given a lower outturn, though I am not sure that, looking to the general poverty of the outturn, this result can be trusted. In the previous year the use of acid gave a large accession to the produce. The difference between the results of the two years may be due to a difference in rainfall conditions. Seed cleaned with acid is likely to suffer from the effects of excessive moisture much more than seed protected by a coating of fibre and dung, and that this is so seems to be borne out by an experiment in progress during the current season.

It may be added that in both experiments the use of manure (hemp or dung) has increased the ratio of lint to seed by about 2 per cent.

10. (2). *Varieties of cotton.*—Fourteen different varieties were grown on four fields, forming four experiments. The results obtained on different fields cannot be compared amongst themselves, as past treatment had been different. The outturns are given below:—

TABLE II.—Cotton; different varieties.

Serial number of experiment.	Number of field.	Number of sub plot.	Area in acres.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
				Crop.	Manure.	Crop.	Manure per acre.	Lint.	Seed.				
								lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	15	1 a	0·13	Wheat	San—hemp ploughed in green.	Cotton, New Orleans	Dung (160 mds).	145	274	10 15 8	13 1 5	37 6 8	Seed obtained from Saharanpur.
		1 b	0·09	Do.	Do.	Do. Louisiana prolific	Do.	120	268	10 15 8	13 1 5	27 7 10	Do.
		2 a	0·05	Do.	Do.	Do. Tree cotton	Do.	104	255	8 7 10	13 1 5	22 1 8	Do.
		2 b	0·06	Do.	Do.	Do. Louisiana prolific	Do.	64	146	8 7 10	13 1 5	15 4 5	Do.
		2 c	0·07	Do.	Do.	Do. Sea Island	Do.	6	11	8 7 10	13 1 5	1 5 6	Do.
2	22	1	0·26	Linseed	Do.	Do. Local Bani	*Nil.*	90	224	11 11 6	*Nil.*	20 14 2	Seed obtained from Hingaghat.
		2	0·26	Do.	Do.	Do. Local Jari	Do.	156	245	11 15 0	Do.	25 7 7	Seed obtained from Katol.
		3	0·26	Do.	Do.	Do. Upland Georgian	Do.	84	195	10 4 0	Do.	21 8 3	Farm acclimatized seed.
3	23	1	0·25	Do.	*Nil.*	Do. Dharwadi	Do.	28	57	7 2 4	*Nil.*	5 5 4	Seed obtained from the Superintendent, Experimental Farm, Bhadgaon.
		2	0·25	Do.	Bone-dust (half)	Do. Varadi	Do.	50	108	7 15 0	Do.	8 8 2	Do.
		3	0·25	Do.	Bone-dust	Do. Nimari	Do.	47	132	8 4 0	Do.	12 4 11	Seed obtained from Khandwa.
4	26	1	0·22	Do.	Dung	Do. Allen	Dung (160 mds).	51	117	5 15 0	12 9 6	13 2 8	Acclimatized seed from Experimental Farm, Bhadgaon.
		2	0·22	Do.	Do.	Do. Bruder	Do.	49	106	6 0 2	12 9 6	8 5 6	Do.
		3	0·22	Do.	Do.	Do. Upland	Do.	62	137	6 5 1	12 9 6	14 2 11	Do.
		4	0·22	Do.	Do.	Do. Louisiana	Do.	62	144	6 7 0	12 9 6	14 4 3	Do.

Experiments Nos. 1 and 4 are vitiated by the fact that the seed was very impure and was found to contain a large quantity of some indigenous variety resembling bani. The seed of the Sea Island cotton from Lahore was also found to be very old and much damaged by insects.

Experiment No. 2 is interesting and important, as it shows the comparative yield of the two principal varieties grown locally—bani and jari—and one American variety—Upland Georgian—which has been grown successfully on the Farm for some years past. The Hinganghat bani variety is greatly superior to the jari, and yet it is gradually going out of cultivation. The American variety is still better than jari in quality, but though large quantities of seed have been distributed *gratis* to cultivators through the Deputy Commissioner, Wardha, and the Manager of the Empress Mills, Nagpur, for the last 5 years, the only result has been to introduce a new variety into a mixture, and, so far as can be ascertained, people have not taken up its cultivation as an unmixed crop. Looking at the above table we find it is not at all surprising that the cultivators prefer to grow the inferior jari, as it pays them best under present circumstances. In the above experiment jari has given 73 per cent. more lint than bani and 86 per cent. more than Upland Georgian.

Taking the value realized per acre into account, the difference, though not so very great, is more than sufficient to account for the superior varieties being driven out of the market. Jari has yielded 22 per cent. more in value than bani and 18 per cent. more than Upland Georgian. It should be noticed here that though Upland Georgian has given less in outturn it has realized better value than bani. I am informed on very good authority that the present price of jari is more than its intrinsic worth, owing to its being largely used for adulterating superior varieties. If means be adopted to check this fraudulent mixing of inferior with good varieties, it would then be interesting to see whether the better varieties could not hold their own against jari, in spite of the latter's larger outturn. I am informed that during the year under report jari was grown to such a large extent at the expense of bani that its price fell to something of its real value, and cultivators who had grown bani realized better profits than those who had put their faith in jari alone.

The percentage of lint in the above three varietis is bani 29, jari 39 and Upland Georgian 30. It will be observed that jari yields by far the largest proportion.

The number of pickings given by each variety is worth noticing. Jari and bani each give generally about 4 pickings and Upland Georgian as many as 8. The latter pickings of the Upland Georgian give a very weak fibre. The pickings of the two former varieties are generally over by the end of January, whilst those of Upland Georgian continue till about May which is considered a disadvantage by the cultivators, as they have to watch the crop for a longer period than bani or jari.

As stated in paragraph 4, the indigenous varieties were attacked by the larva of a Buprestid beetle, while the American variety was free from them.

11. The next Experiment (No. 3) compares the outturn of two varieties from Bhadgaon and one from Khandwa.

The Dharwari cotton is an American acclimatized variety, and the Waradi (or Berari) is similar to Nagpur jari. The Nimari variety from Khandwa was brought to my notice when I visited that place in December 1890. It is a superior variety resembling Hinganghat bani, but on enquiry I found that like the bani it was being gradually supplanted by the Waradi or Berari variety. I showed the sample of Nimari cotton which I had brought with me to the Manager of the Empress Mills, who considered it equal to, if not better than, the best Hinganghat.

In the above experiment, though Nimari has given 6 per cent. less lint than Waradi, it has realized 45 per cent. more in value, and the experiment throws little light as to why the inferior variety is taking the place of Nimari. The difference in the soil and climate should, however, be taken into account, and it is not safe to draw inferences from a single experiment. The outturn of the different varieties is also very low considering that the field was a fairly good one. The percentage of lint in the three varieties was Dharwari 29, Waradi 32 and Nimari 26.

A trial was also given to what is called the Chanda "cold weather jari" cotton. It is a superior variety, resembling bani, grown in Chanda in the cold season. Field No. 32 measuring ·32 of an acre was sown in October with this variety. Half of the field was irrigated twice, but in both the irrigated and unirrigated plots the outturn was very poor, *viz.*, 18 lbs. and 27 lbs. respectively of seed cotton per acre; the produce was moreover of very poor quality. In the year 1885-86 this cotton was tried on the Farm both as a kharif and a rabi crop. The kharif crop yielded about 200 lbs. and the rabi crop 52 lbs. of seed cotton per acre.

12. Samples of all the above varieties were sent to the Manager of the Empress Mills, Nagpur, for opinion. He has very kindly sent a full report on them which is abstracted below :—

No.	Name of variety.	Name of locality whence seed was obtained.	Class of lint.	Value per bojha of 345 lbs.	Remarks.
				Rs.	
1	Upland Georgian ...	Government Farm, Nagpur ...	1st Class ...	79	Good staple, strong, better than Hinganghat.
2	Nimari ...	Khandwa ...			Good staple, as good as, if not better than Hinganghat.
3	Allen ...	Government Farm, Bhadgaon.			Good staple, strong.
4	New Orleans ...	Saharanpur ...			Do.
5	Tree cotton ...	Do. ...	2nd Class.	70	Fairly good and strong.
6	Bani ...	Hinganghat ...			Irregular in length, strong, not so good as No. 2 and that available at Hinganghat.
7	Dharwadi ...	Government Farm, Bhadgaon.			Irregular in length, fairly strong, inferior to No. 6.
8	Louisiana ...	Do. ...			Slightly better than No. 9.
9	Upland ...	Do. ...			Medium, fairly strong, inferior to good bani.
10	Louisiana prolific ...	Saharanpur ...			Medium, weak.
11	Bruder ...	Government Farm, Bhadgaon.	3rd Class...	50	Short and weak, better than No. 14.
12	Varadi or Berari ...	Do. ...			Very short, stronger than No. 14, not so good as jari available here.
13	Jari ...	Kelod, Nagpur district ...			Very short and extremely weak, unlike ordinary available jari.

It should be explained here that the Farm lands are in soil and situation not as suitable for the growth of cotton as the majority of the fields in which it is grown in the district, and that it is to this that I attribute the falling off in quality which is evidenced by the remarks against samples Nos. 6 and 13.

13. (3). *Effect of mixing cotton.* —In the table which follows is shown the result of an experiment to test the results of sowing cotton as a mixed crop with tur and juar, as is generally done by cultivators, against sowing it alone. In plots 2 and 3 one line of tur and of juar was sown respectively to every 6 lines of cotton :—

TABLE III.—Cotton; mixed crops.

Number of field.	No. of sub-plot.	Area in acres.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.	Cost of cultivation per acre.	Cost of manure per acre.	Value of produce per acre.	Remarks.
			Crop.	Manure.	Crop.	Manure.					
							lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
37	1	0·34	Wheat.	San-hemp ploughed in green.	Bani cotton alone.	*Nil.*	Lint 42, seed 100	4 11 0	*Nil.*	9 11 1	A poor field.
...	2	0·34	do.	do.	Mixture of bani cotton and tur in the proportion of 6 lines of former to 1 of latter.	do.	Lint 30, seed 74. Grain 410, chaff & stalks 912.	5 12 8	do.	17 10 9	.....
...	3	0·34	do.	do.	Mixture of bani cotton and juar in the proportion of 6 lines to 1.	do.	Lint 31, seed 73. Grain 32, karbi 324	*4 10 9	do.	9 11 7	*Excluding cost of watching juar, which came to Rs. 7-5-8 per acre.

The admixture with cotton of tur or juar has in no way improved its outturn. Excluding the area of tur and juar from plots 2 and 3 and taking into consideration the area of cotton only, the plots have yielded at the rate of 34 and 36 lbs. of lint respectively per acre, that is 19 and 14 per cent. less than plot No. 1. Comparing plots 2 and 3 among themselves, we find the outturn of lint about the same in both. Looking at the column of value realized per acre, we find that the mixture of cotton and tur has yielded a great deal more than the other two plots. The increase is due to tur alone, which has generally proved a better paying crop on the Farm than either juar or cotton. The yield is a very poor one, and the outturn of cotton in all the three plots is very low.

In plot 3 the cost of protecting the juar from birds, &c., has not been included in the cost of cultivation, but is shown separately in the column of remarks. The fields to be watched being very small in area and situated in different parts of the Farm, the cost of watching has, in many cases, been very high, as separate watchmen had to be engaged for small areas, and is moreover disproportionately high in the case of small fields.

14. Field No. 33 has been reserved for experiments in rotations with cotton which had not been thoroughly started during the year. Two plots were grown with cotton mixed with tur, and yielded respectively at the following rates per acre:—

No. of plot.	Outturn per acre.				Cost of cultivation per acre.	Value of outturn per acre.
	Cotton.		Tur.			
	Lint.	Seed.	Grain.	Chaff.		
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
1	32	49	396	482	10 5 2	15 8 9
2	54	85	633	779	11 13 4	25 6 4

The difference in the outturn of the two plots is due to the fact that one plot was more water-logged than the other. Since the crop was cut this difference has been (it is hoped) removed by the construction of surface drains.

TABLE IV.—Juar; manures.

15. JUAR. (1) *Manures.*—The following experiment was made with cattle dung and bone dust on juar :—

Number of field.	Number of sub-plot.	Area in acres.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
			Crop.	Manure.	Crop.	Manure per acre.	Grain.	Karbi.	Actual.		Percentage.					
									Grain.	Karbi.	Grain.	Karbi.				
							lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
42	1	0·38	Wheat...	Dung ...	Juar...	Dung (160 maunds) ...	229	1,829	+71	+8	+45	+·4	3 10 7	12 13 2	15 7 0	Cost of watching the plots—Rs. 2-10-1 per acre.
	2	0·38	Do. ...	Do. ...	Do....	*Nil.* ...	158	1,821	...	...	...	—	4 13 8	*Nil.*	14 2 0	
	3	0·38	Do. ...	Do. ...	Do....	Bone dust (360 lbs) ...	145	1,750	—13	—71	—8	—4	5 2 5	3 13 3	13 7 2	

Plot No. 3 suffered from excessive rain much more than the other two. The experiment shows that manuring for juari with cattle dung increases the produce, but this was known before. As a measure of increase the experiment is unreliable, owing to the plots having been unequally affected by the weather.

TABLE V.—Juar; different varieties.

16. (2) *Varieties of juar.*—Four varieties of juar obtained from out-districts were grown side by side:—

Number of field.	Number of sub-plot.	Area in acres.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
			Crop.	Manure.	Crop.	Manure per acre.	Grain.	Karbi.				
							lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
38	1	0·06	Wheat.	*Nil.*	Juar, Chirola ...	Dung (160 maunds) ...	479	2,500	5 10 3	14 15 2	25 5 2	Seed obtained from Damoh.
	2	0·06	Do.	Do.	„ Bansmati...	Do.	312	3,733	5 10 3	14 15 2	29 8 9	Do. Saugor.
	3	0·06	Do.	Do.	„ Badela ...	Do.	617	2,983	6 1 2	14 15 2	31 2 5	Do. do.
	4	0·06	Do.	Do.	„ Jogan ...	Do.	317	2,600	6 1 2	14 15 2	20 15 11	Do. Damoh.

Chirola is the variety preferred by people for food. Bansmati is almost as good, but has rather a bitterish taste. Badela is inferior to both these and does not make good bread (chapatis) as the dough does not hold together well but is liable to crumble—the result probably of an insufficient quantity of gluten in the grain. All these varieties realized the same price in the market, *viz.* Rs. 8 per khandi. The Jogan variety is brick red in colour and of a very inferior quality. It realized Rs. 6 per khandi. Its chief value lies in its supposed immunity from the attack of birds. But no such peculiarity was observed in the above experiment, the birds devouring it equally with the other varieties. It is possible that the birds do not relish it so much as the other good varieties, and may leave it untouched if they find grain of better varieties sufficient for their purpose.

17. The plots of permanent Manure Series C, which have been cropped with wheat for the last six years, were sown with juar in the year under report, without the application of any manures, to give the plots a change of crop. The results are very discrepant and are not worth publishing. The plots are, owing to their shape and situation, liable to be water-logged with heavy rain, and they have proved very unsuitable for either juar or cotton.

18. The non-experimental area under crop in the kharif season was 20·31 acres (Annexure C), half of which was devoted to juar grown for fodder and tur. The juar yielded at the rate of 3,472 lbs. of green fodder per acre, worth Rs. 11-5-9, obtained at an outlay of Rs. 4-13-8. The average yield for the five previous years is 4,006 lbs. per acre. Tur gave 588 lbs. grain, worth together with chaff and straw Rs. 18-3-3, on an outlay of Rs. 8-8-0. The average outturn for the five preceding years is 624 lbs. This is the crop of all others for which the Farm land is best suited, and which would be most largely grown were the Farm worked for profit.

19. A large quantity of the green *juar* fodder and some of the produce of the field permanently laid down with Guinea grass were made into silage. In previous years the silos which were used were merely pits in the ground. During the year under report the bottom and sides of the pits have been lined with brick masonry, and the pits covered over with light thatched roofs. The capacity of one silo is 480 c. ft. and of the other 1,522 c. ft. They cost respectively Rs. 85 and Rs. 188, roofing included. The small silo was filled with Guinea grass and the large one with juar stalks, cut green while in flower. The fodder was covered over with a layer of earth 1½′ deep. The results were as follows:—

TABLE V I.—Ensilage.

No of silo.	Fodder put in.		Time taken for filling and ramming.	Date of opening.	Quantity of silage taken out.		Percentage of good silage on total quantity put in.	Percentage of damaged silage on total quantity produced.	Cost of cutting, filling, ramming, covering, &c.	Cost of making a maund (80 lbs) of good silage.
	Kind.	Quantity.			Good.	Bad.				
		lbs.			lbs.	lbs.			Rs. a. p.	Rs. a. p.
A	Guinea grass ...	7,743	From 22nd October 1890 to 3rd November 1890.	15th March 1891.	5,820	119	75	2	5 3 6	0 1 2
B	Juar stalks ...	18,890	From 4th November 1890 to 25th November 1890.	3rd April 1891 ...	12,852	455	68	3·4	14 1 2	0 1 5

The operation of filling was prolonged by the occurrence of showers of rain, especially in the case of the larger silo.

C.—RABI EXPERIMENTS.

20. Experiments were made with wheat and linseed, those with each crop being as detailed below:—

With wheat.—To test the effect of (1) various manures with and without irrigation, (2) embanking, (3) growing in mixture, (4) deep tillage, (5) thick *versus* thin sowing, (6) selection of seed, (7) pickling seed as a preventive against fungoid disease.

With linseed—To test the effect of (1) various manures, (2) two different varieties.

21. WHEAT. (1) *Manures.*—The experiments under this head may be classed as (*a*) those made on the permanent series of "manure plots," (*b*) those made on the "Ville plots," and (*c*) those made on other fields.

TABLE VII.—Wheat; permanent manure plots, Series A—unirrigated.

The results obtained on the permanent duplicate series of manure plots are shown in the two following tables—one series of plots was unirrigated, the other series was irrigated once :—

No. of plot.	Area.	Treatment in preceding six years.		Average outturn per acre for preceding six years.		Percentage of increase (+) or decrease (—) per acre over unmanured plot.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
		Crop.	Manure.	Grain.	Straw.	Grain.	Straw.	Crop.	Manure per acre.	Grain.	Straw.	Actual.		Percentage.				
												Grain.	Straw	Grain.	Straw.			
	Acres.			lbs.	lbs.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.
I	0·10	Wheat ...	The same as in year under report.	1,204	1,711	+42	+32	Wheat (hauna)	Saltpetre (240 lbs.) ...	1,227	2,390	+712	+1,418	+138	+145	14 12 8	30 0 0	48 15 2
II	0·10	do. ..		922	1,388	+9	+7	do. ...	Bone dust (360 lbs.) ...	635	925	+170	—47	+33	—5	14 6 10	3 6 0	25 12 3
III	0·10	do. ...		1,132	1,751	+34	+35	do. ...	Saltpetre (240 lbs.) and Bone dust (360 lbs.),	1,360	2,620	+845	+1,648	+164	+169	15 4 2	33 6 0	54 1 11
IV	0·10	do. ...		928	1,520	+10	+17	do. ...	Dung (160 mds.) ..	937	2,072	+422	+1,103	+82	+113	14 3 6	12 0 6	38 5 1
V	0·10	do. ..		981	1,415	+16	+9	do. ...	Dung (160 mds.) and Bone dust (360 lbs.)	755	1,495	+210	+523	+47	+51	13 15 4	15 6 6	30 3 3
VI	0·10	do. ...		1,023	1,598	+21	+23	do. ...	Ashes of 160 mds. of dung.	717	1,427	+202	+455	+39	+47	13 4 6	13 2 10	28 11 6
VII	0·10	do. ...		842	1,297	...	...	do. ...	Nil.	515	972	...	...	...	...	13 0 4	Nil.	20 6 9
VIII	0·10	do. ...		744	1,137	—12	—12	do. ...	Green-soiling with San—hemp.	760	1,317	+245	+345	+47	+35	10 6 8	9 8 6	29 11 0

No. of plot.	Area.	Treatment in preceding five years.						Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Cost of cultivation per acre.	Cost of special treatment per acre.		Value of produce.
		Manure.	1885-86 and 1887-88.		1886-87.		1888-89 and 1889-90.					Actual.		Percentage.			Manuring.	Irrigation.	
			Crop.	Average outturn per acre.	Crop.	Outturn per acre.	Crop.	Average outturn per acre.	Crop.	Manure per acre.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.			
	Acres.			lbs.		lbs.		lbs.			lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	0·10	The same as in the year under report.	Linseed	25	Wheat	1,290	Til	593	Wheat (haura)	Saltpetre (240 lbs.) ...	1,532	2,662	+730	+1,627	+91	+157	12 3 10	30 0 0	6 12 9	57 15 7
II	0·10		do.	235	do.	1,320	do.	577	do.	Bone dust (360 lbs.) ...	937	1,265	+135	+230	+17	+22	11 6 6	3 6 0	do.	34 1 5
III	0·10		do.	23	do.	1,210	do.	565	do.	Saltpetre (240 lbs.) and Bone dust (360 lbs.).	1,502	3,005	+700	+1,955	+87	+189	11 14 10	33 6 0	do.	58 5 4
IV	0·10		do.	28	do.	960	do.	483	do.	Dung (160 mds.) ...	1,037	1,495	+235	+460	+29	+44	11 14 10	12 0 6	do.	38 1 4
V	0·10		do.	205	do.	960	do.	48[illegible]	do.	Dung (160 mds.) and Bone dust (360 lbs.).	1,035	1,47[illegible]	+233	+440	+29	+42	11 10 8	15 6 6	do.	37 14 11
VI	0·10		do.	63	do.	1,120	do.	382	do.	Ashes of 160 mds. of dung	962	1,050	16[illegible]	+15	+20	+1	11 0 8	13 2 10	do.	34 0 11
VII	0·10		do.	215	do.	830	do.	361	do.	*Nil.* ...	802	1,035	...	...	...	...	10 15 6	*Nil.*	do.	28 15 11
VIII	0·10		do.	91	do.	1,066	do.	246	do.	Green soiling with San—hemp.	925	1,487	12[illegible]	+452	+15	+43	9 13 6	9 8 6	do.	34 8 8

TABLE VIII.—Wheat; permanent manure plots, Series B—irrigated.

Taking the unirrigated series first, it is noticeable that bone dust used alone has added considerably to the produce, but that when used with dung it has produced no effect—indeed has apparently lessened the outturn, though the decrease must be due to accidental causes. This would appear to show that the bone dust was more valuable for the nitrogen than for the phosphate it contains. Nitrogenous manures have throughout shown the best, saltpetre being by far the most effective. Green soiling has given a much better outturn than in previous years. This is owing to the character of the rainfall—the heavy rains at the end of the monsoon favouring the decomposition of the san hemp which was ploughed in, and the loss of moisture from the ground, due to the soil being opened up at the time of ploughing in the hemp, being compensated by the favourable cold weather showers. So far as profit and loss are concerned, dung has paid the best result in spite of the high rate at which its cost is calculated. Green soiling and bone dust also leave a margin of profit larger than that gained on the unmanured plot, but the other manures show poorly. I may remark that dung ashes show no extra profit over the unmanured plot, simply because of the very high rate at which their cost is calculated. The rate is arrived at by taking the full value of dung and adding. to it the cost of burning it for making it into ashes. Ordinarily dung ashes are available as a waste product, and the only extra charge would be for cartage.

Turning now to the irrigated series, it will be seen that the effect of the watering has been apparently to increase the relative yield of the unmanured plot (which gave over ten maunds after seven years' continuous cropping), and the proportionate profit on the manured plots has accordingly fallen, although their actual outturns are considerably larger than those obtained on the unirrigated series.

The year under report was extremely unfavourable for testing the effect of irrigation. The cold weather showers were sufficient and there was practically very little to be gained by irrigation. Only one watering was given on the 21st January when the plants were in flower. Immediately after the irrigation about 0·7 inch of rain fell. Irrigation added about 12 per cent. to the grain outturn of all plots taken together—but added very little to the straw. It was effected by means of a pipe laid on from the water-supply of the adjoining Government gardens. The cost of irrigation is calculated as follows:—Three inches of water over the surface, or 10,890 c. ft. per acre, are taken as sufficient for irrigating wheat when the soil is in a dry condition. An ordinary well bucket worked by bullocks can draw 200 c. ft. of water per hour from a well 25' deep, which gives 1,800 c. ft. of water per day of 9 hours. Taking the cost of bullocks at 12 annas per day and the wages of the driver at 3 annas, the cost of raising 1,800 c. ft. of water is Re. 0-15-0, and at this rate the cost of raising 10,890 c. ft. required for an acre comes to Rs. 5-10-9. To this is added Rs. 1-2-0 for the wages of the man required to irrigate the fields. The total cost of one irrigation thus comes to Rs. 6-12-9 per acre. Next year careful measurements will be taken of the amount of water actually used.

The crop on both series suffered considerably from rust, the grain being much shrivelled. It was noticed that the plots having nitrogenous manures, especially saltpetre, were more damaged than those which had mineral manures alone or no manure. Both the irrigated and unirrigated series appeared to have suffered equally, and irrigation made no difference in this respect.

22. During the year under report the Ville plots were transferred to field No. 36, as the former plots were found to differ in natural fertility. Field No. 36 had for the last six years received no manure, and was therefore in the best of conditions for this experiment. The only defect in the field was that it was depressed in some parts where water stagnated during rain. Before sowing, the field was levelled by bullock hoeing and drawing the earth from the higher to the lower-lying parts. This levelling made the seed bed uneven, it being very loose in places where the earth had been drawn over. The first sowing therefore germinated unevenly, and opportunity was taken of a good fall of rain on the 8th November to re-sow the plots. The crop was very vigorous and was in full bloom when the attack of rust

came on. It was feared that the crop would be completely spoiled, but fortunately this fear proved groundless and the crop yielded a much better outturn than was expected. The results are shown below :—

TABLE IX—Wheat : Ville Series—Irrigated.

No. of field.	No. of sub-plot.	Area.	Treatment in preceding six years.						Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Remarks.
			1884-85, 1887-88 and 1888-89.			1885-86, 1886-87 and 1889-90.							Actual.		Percentage.		
			Crop.	Manure.	Average outturn per acre.	Crop.	Manure.	Average outturn per acre.	Crop.	Manure per acre.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	
		Acre.			lbs.			lbs.			lbs.	lbs.	lbs.	lbs.			
36 Ville.	I.	0·05	Cotton ...	*Nil* ...	Clean cotton 59	Wheat ...	*Nil* ...	654	Wheat (haura)	Ammonic chloride (140 lbs.) Superphosphate (180 lbs.) Potassic sulphate (90 lbs.) and Calcic sulphate (100 lbs.)	1,435	2,845	+670	+1,235	+87	+77	The cost of cultivation, &c., is not given, as this experiment has no bearing on profit or loss. The plots were all once irrigated between the 11th and 13th February.
	II.	0·05	do. ...	do. ...	do. ...	do. ...	do. ...	do.	do. ...	As in I, less superphosphate ...	1,270	2,605	+505	+995	+66	+61	
	III.	0·05	do. ...	do. ...	do. ...	do. ...	do. ...	do.	do. ...	„ less ammonic chloride ...	805	1,910	+40	+300	+5	+18	
	IV.	0·05	do. ...	do. ...	do. ...	do. ...	do. ...	do.	do. ...	No manure ...	765	1,610	...	...	...	...	
	V.	0·05	do. ...	do. ...	do. ...	do. ...	do. ...	do.	do. ...	As in I, less potassic sulphate ...	1,455	2,920	+690	+1,310	+90	+81	
	VI.	0·05	do. ...	do. ...	do. ...	do. ...	do. ...	do.	do. ...	„ less calcic sulphate ...	1,270	2,865	+505	+1,255	+66	+78	

The experiment differed from similar ones in preceding years in that the effect of the manures was brought out by irrigation, though the season was not a favourable one for this purpose. The plots manured with nitrogen suffered more from rust than the others.

The results show very clearly that the chief want of the soil is nitrogen, though it also lacks phosphoric acid and lime. It is curious that the omission of lime should have reduced the crop so much, as lime is found in abundance in the form of kankar (impure carbonate of lime) in the farm soil, layers of it being generally found a few feet below the surface. It is possible that the surface soil may not contain sufficient lime, as lime has a tendency to sink into the ground with every shower of rain.

The results agree in a remarkable way with those obtained at Rothamsted, in the continuous growth of wheat for 36 years. I give an abstract of the Rothamsted results below:—

Plots.	Manures, per acre, per annum.	Average produce of 36 years, per acre, per annum.		Increase per cent.	
		Dressed grain.	Straw.	Grain.	Straw.
		Bushels.	Cwts.		
9 b	275 lbs. nitrate of soda (sown in the spring)—*Nitrogen alone.*	23⅜	24¼	80	120
5 a & b	200 lbs sulphate potass; 100 lbs sul. soda, 100 lbs sul. magnesia, 3½ cwt. superphosphate—*Minerals alone.*	15⅓	12⅝	16	14
0	10½ cwt. superphosphate of lime—*Phosphoric acid alone.*	16¼	13⅜	25	21
1	Sulphate of potass, soda and magnesia (twice as much as plot 5)—*Alkalis alone.*	13	11⅓	0	5
3	No manure	13	11	...	...

23. The following table shows the results obtained on other plots by manuring wheat with green soiling, with ing collected in boxes and in ordinary stalls, with saltpetre, with lime, and (in the previous year) with poudrette :—

TABLE X.—Wheat; various manures.

Serial No. of experiment.	No. of field.	Sub-plot.	Area.	Treatment in preceding year. Crop.	Treatment in preceding year. Manure.	Treatment in year under report. Crop.	Treatment in year under report. Manure per acre.	Outturn per acre. Grain.	Outturn per acre. Straw.	Increase (+) or decrease (—) per acre over unmanured plot. Actual. Grain.	Actual. Straw.	Percentage. Grain.	Percentage. Straw.	Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
			Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p	Rs. a. p.	Rs. a. p	
1	17	1	0·23	Cotton ...	Dung ...	Wheat (kathia.)	Green soiling with *Iarata* (Cassia auriculata).	665	1,239	+ 222	+ 517	+ 50	+ 67	12 10 6	7 10 9	22 2 6	
		2	0·23	Do. ...	do. ...	do. ...	*Nil.* ...	443	722	...	...	...	...	15 3 10	*Nil.*	14 5 11	
2	18	1	0·26	Cotton and wheat.	Dung and bone-dust.	Wheat (hauri.)	Green soiling with san hemp.	784	1,185	+ 122	+ 223	+ 20	+ 23	10 11 9	10 9 6	23 5 7	
		2	0·26	Do. ...	do. ...	do ...	*Nil.* ...	612	962	...	...	...	...	14 5 5	*Nil.*	23 8 7	Irrigated once. The cost of irrigation = Rs. 6-12-9, calculated as in Manure Series B.
		3	0·26	Do. ...	do. ...	do. ...	Box dung (160 mds.)	681	1,158	+ 69	+ 196	+ 11	+ 20	13 7 4	13 12 11	26 7 5	
		4	0·26	Do. ...	do. ...	do. ...	Stall-dung (160 mds)	837	1,429	+ 225	+ 467	+ 37	+ 7	13 10 10	13 12 11	31 0 11	
3	68	1	0·02	Cotton ...	Dung ...	Wheat (kathia.)	*Nil.* ...	525	1,075	...	...	...	...	10 15 0	*Nil.*	17 13 8	
		2	0·10	Do. ...	do. ...	do. ...	Saltpetre (240 lbs.)	1,227	3,275	+ 702	+ 2,200	+ 134	+ 205	15 6 8	30 0 0	44 9 8	
		3	0·10	Do. ...	do. ...	do. ...	do. (80 lbs.) top dressing.	567	1,135	+ 42	+ 60	+ 8	+ 6	11 4 10	10 5 0	19 2 11	
4	65	1	0·46	Do. ...	*Nil* ...	Wheat (hauri.)	Caustic lime (3 tons).	647	990	+ 85	— 495	+ 15	— 33	11 11 10	85 5 7	23 15 6	Another application of lime will not be necessary for 12 years, and hence the cost of manure during the year should be taken as Rs. 7-1-10.
		2	0·49	Do. ...	do. ...	do. ...	*Nil.* ...	562	1,485	...	...	...	...	11 2 9	*Nil.*	23 3 0	
5	59	1	0·31	Do. ...	do. ...	Wheat (hauri.)	*Nil.* ...	559	941					10 7 0	*Nil.*	19 10 1	
		2	0·31	Do. ...	do. ...	do. ...	do. ...	590	1,158					11 6 6	do.	21 5 6	The average of plots 4 and 5 is compared with the average of plots 1 and 2 taken as the unmanured plots. Plot 3 is left out of account, as half of it was manured and the other half unmanured last year.
		3	0·31	Do. ...	Half *Nil.* Half poudrette, 200 mds. per acre.	do. ...	do. ...	507	1,680	...	...	...	...	10 10 5	do.	20 14 11	
		4	0·31	Do. ...	Poudrette, 200 mds. per acre.	do. ...	do. ...	982	1,511	+ 284	+ 498	+ 50	+ 47	10 10 2	do.	33 15 3	
		5	0·31	Do. ...	Poudrette, 200 mds. per acre.	do. ...	do. ...	736	1,574					11 4 10	do.	27 1 6	

In Experiment No. 1 a leguminous weed (*tarola* or *tarwar*—Cassia auriculata), growing very luxuriantly on waste land, was cut and brought to the field and ploughed in, in the middle of August. A heavy shower fell immediately after it was ploughed in, and the subsequent rain was favourable to its decomposition. Its use increased the outturn by 50 per cent. and gave an extra profit of about Rs. 3 per acre.

In Experiment No. 2, san-hemp was sown in plot 1 and it was ploughed in on the 9th of August when the plants were about 5 feet high. Here also the green soiled plot has given a much larger outturn than the unmanured plot, though not so large as that gained in the first experiment. Box-dung gave a less outturn than stall-dung, though it is of course much richer than the latter. In the stall-dung only the solid excrements are collected and kept in pits in the open, while in the box-dung all the urine is also collected with the solid excrements. But it contains at the same time a large quantity of straw, &c., which is used for bedding and for the absorption of the urine, and hence, though the total manure produced by the box system by one pair of bullocks is richer than that produced by the stall system in the same period, it may not necessarily be richer weight for weight, and I think the mistake made in the above experiment was using the same weight per acre of both kinds of manures. It has been ascertained at the Saidapet Farm, Madras, by weighing the manure produced by both the systems, that a bullock will produce about 26 lbs of *well decayed* box-dung per day, against only about 8 lbs. by the ordinary system. From weighings made last year on the Farm for a few days, it was found that a bullock produces about 37½ lbs of box manure and about 25 lbs. of stall manure per day. The stall manure was not properly decayed, and hence the actual weight would be less than 25 lbs. Arrangements have now been made to collect the manure from a pair of bullocks by both the systems for a whole year, and in the meantime it has been decided to use the two kinds of manures in the proportion of 37½ to 25, or 240 maunds of box manure to 160 maunds of stall manure, per acre, for the current year's experiments.

The discrepancy may also be partly due to rust which affected the crops unequally. In fact all the wheat experiments of the year are more or less vitiated on that account.

In the third Experiment, 240 lbs. of saltpetre were drilled in with the seed in plot 2, and plot 3 had received a top dressing of 80 lbs of saltpetre a little before the time of flowering. Unfortunately heavy rain fell just before the time of the application of the top dressing, and the very wet condition of the ground prevented artificial irrigation immediately after the application of the top dressing, otherwise the result would have been much more favourable.

In Experiment No. 4, though lime increased the outturn in grain, there is a great decrease in straw, and the experiment indicates that the soil does not contain much organic matter.

Experiment No. 5 was meant for the purpose of equalizing the plots for future experiments and at the same time to test the residual effect of poudrette applied last year. The result shows that poudrette exerts a most powerful effect in the second crop after its application.

24. (2) *Embanking.*—The results obtained from *embanked* land during the year under report were very encouraging. This was partly due to a change in the method of cultivation—the system followed in embanked land in the Jubbulpore district having been adopted—the land not being bakhared before sowing. It is also partly due to the favourable character of the rainfall—the fall having been sufficient to keep the fields full of water.

The following table compares the results (No. 1) of embanking with and without manure, (No. 2) of embankments which keep the field full of water, and those which only keep the field partly covered, (*a*) with manure and (*b*) without manure, and (Nos. 3 and 4) of embanked as compared with unembanked land with manure and without manure. Field No. 18, which is selected

as typical of unembanked land, is naturally of better quality than the embanked lands with which it is compared :—

TABLE XI.—Wheat; embankments.

Serial No. of experiment.	No. of field	Sub-plot.	Area.	Treatment in preceding years. 1884-85, 1886-87 and 1887-88. Crop.	Average outturn per acre.	1885-86. Crop.	Outturn per acre.	1888-89. Crop.	Outturn per acre.	1889-90. Crop.	Outturn per acre.	Treatment in year under report. Crop.	Special treatment.	Outturn per acre. Grain.	Straw.	Increase (+) or decrease (−) over unmanured or unembanked plot. Actual. Grain.	Straw.	Percentage. Grain.	Straw.	Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
			Acre.		lbs.		lbs.		lbs.		lbs.			lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	41	A.	0·303	Wheat	408	Linseed.	145	Linseed.	60	Wheat	*258	Wheat haura.	Embanked .. Dung (160 mds).	1,196	1,354	+392	+325	+49	+32	5 8 6	14 8 0	41 0 2	These plots held water continuously.
	43	A.	0·35	Do.	312	Wheat	413	Do.	219	Do.	*262	Do.	Embanked ... No manure	804	1,029	...	...	...	...	7 13 6	*Nil.*	28 0 0	
2	41	A.	·303	Do.	408	Linseed.	145	Do.	60	Do.	*258	Do.	Embanked, dung...	1,196	1,354	+503	+477	+72	+20	5 8 6	14 8 0	41 0 2	41B and 43B did not hold water properly.
	41	B.	·318	Do.	389	Do.	138	Do.	57	Do.	*246	Do.	Do. do. ...	693	877	...	...	...	...	9 5 3	14 8 0	24 1 5	
	43	A.	0·35	Do.	312	Wheat	413	Do.	219	Do.	*262	Do.	Embanked, *Nil* ...	804	1,929	+463	+417	+135	+58	7 13 6	*Nil.*	28 0 0	
	43	B.	·358	Do.	306	Do.	404	Do.	214	Do.	*267	Do.	Do. do. ...	341	612	...	...	...	...	7 10 8	*Nil.*	12 8 8	
3	41	A.	0·303	Do.	408	Linseed.	145	Do.	60	Do.	*258	Do.	Embanked ... Dung (160 mds).	1,196	1,354	+359	+325	+43	+32	5 8 6	14 8 0	41 0 2	This plot held water continuously.
	18	4	0·26	Do.	749 (in 1887-88.)	Wheat	461	...	...	Do.	142	Do.	Unembanked ... Dung (160 mds).	837	1,029	...	...	...	...	13 10 10	13 12 11	31 0 11	
4	43	A.	0·35	Do.	312	Do.	413	Linseed.	219	Do.	*262	Do.	Embanked ... No manure.	804	1,029	+192	+67	+31	+7	7 13 6	*Nil.*	28 0 0	This plot held water continuously.
	18	2	0·26	Do.	749 (in 1887-88).	Do.	461	...	...	Do.	142	Do.	Unembanked ... No manure.	612	962	...	...	...	...	14 5 5	*Nil.*	23 8 7	

* These plots had received dung manure, the others were unmanured.

Embanking with manure added Rs. 10 to the outturn (No. 3), and without it added Rs. 4-8-0.

The use of manure in embanked land superadded over Rs. 13 to the profit (No. 1), though this did not quite cover the cost of the manure, which (as previously noted) is calculated at the very high rate of one anna per maund.

Embankment did not apparently add to the damage from rust.

25. (3). *The effect of growing wheat in a mixture.*—In field No. 25 wheat was tried alongside of a mixture of wheat and gram. The wheat was sown at the rate of 50 lbs. to the acre—the wheat-gram at the rate of 25 lbs. of wheat and 25 lbs. of gram. The results were as follows:—

TABLE XII.—Wheat; mixed crops.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
			Crop.	Manure.	Crop.	Manure.	Grain.	Straw.			
		Acre.					lbs.	lbs.	Rs. a. p.	Rs.	Rs. a. p.
25	1	0·21	Cotton	Bone dust.	Wheat (haura).	*Nil.*	704	973	12 9 7	*Nil.*	24 12 10
,,	2	0·21	Do.	Do.	Wheat and Gram.	Do.	Wheat 473. Gram 332.	Wheat 571 Gram 501	13 1 11	*Nil.*	27 11 6

The mixing of gram lessened of course the outturn of wheat, but gave a larger profit.

26. (4) *The effect of deep tillage.*—Cultivators in the neighbourhood of the Farm are of opinion that ploughing up land every year is injurious rather than beneficial to crops, especially rabi crops. If this is true, it is I think due to the soil of the Farm and its neighbourhood being very thin, poor and gravelly, and ploughing it up often would, by making the seed-bed very loose, be detrimental to wheat and other rabi crops. The defect, I think, could be remedied by pressing the soil by a large block of wood drawn by bullocks over the soil, with the driver standing on it, as is sometimes done by cultivators, and in the end the practice of ploughing up the soil every year would, I think, be beneficial by making it gradually deeper and finer year by year. The following experiment has been initiated (and will be carried on year after year) to test the truth of the local belief that deep ploughing is detrimental:—

TABLE XIII.—Wheat; tillage.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (−) per acre over standard plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
									Actual.		Percentage.					
			Crop.	Manure.	Crop.	Special treatment.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.				
		Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
21	1	0·23	Cotton	*Nil.*	Wheat (pissi).	Soil ploughed and bakhared (bullock hoed).	616	1,327	−115	−119	−16	−8	13 6 2	*Nil.*	23 10 1	This plot is to be ploughed every year.
	2	0·23	Do. ...	do. ...	do. ...	Soil bakhared only.	731	1,446	...	...	...	...	12 15 3	do. ...	26 7 3	This is not to be ploughed at all.
	3	0·23	Do. ...	do. ...	do. ...	Soil ploughed and bakhared.	740	1,090	+9	−356	+1	−74	13 14 1	do. ...	26 5 3	This is to be ploughed every 3rd year.

This year's result on the whole is unfavourable to ploughing. Plots 1 and 3 were each ploughed up once on 6th July and bakhared 6 times at intervals from 23rd May to 24th October. Plot 2 was only bakhared 7 times on the same dates as Plots 1 and 3.

27. (5) *Thin versus thick sowing.*—In the following experiment wheat was sown at four rates per acre, *viz.*, 55 lbs., 80 lbs., 108 lbs. and 125 lbs.

TABLE XIV. Wheat; rates of sowing.

No. of field.	Sub-plot.	Area	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over standard plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.	Remarks.
									Actual.		Percentage.					
			Crop.	Manure.	Crop.	Special treatment.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.				
		Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
40	1 a	0·06	Cotton	*Nil.*	Wheat.	No manure, 55 lbs. seed sown per acre.	812	1,420	...	...	...	...	12 3 10	*Nil.*	29 11 9	Plot 1 is the standard plot, the sowings made on the Farm being generally at the rate of 60 lbs. per acre.
	1 b	0·06	do. ...	do.	do. ...	do. 80 lbs. per acre.	654	1,845	—158	+425	—20	+30	12 12 2	*Nil.*	26 9 8	
	2 a	0·06	do. ...	do.	do. ...	do. 108lbs. per acre.	883	2,433	+71	+1,013	+9	+71	15 7 2	*Nil.*	35 11 3	
	2 b	0·06	do. ...	do.	do. ...	do. 125lbs. per acre.	766	2,066	—46	+646	—6	+46	15 7 2	*Nil.*	30 12 3	

The 108 lbs. rate has given the best outturn, though from general observation I think that 60 lbs. per acre is the most suitable quantity. The experiment will be continued next year on a larger area. As explained in a previous paragraph, the results may have been affected by rust unequally.

28. (6) *Selection of seed.*—In the year 1886-87 a small plot of highly manured ground was sown with specially selected seed. Every year since the best seed from the crop is selected and sown on a manured field, with irrigation. In the following experiment this selected or pedigree wheat was tried against the ordinary seed with the following results :—

TABLE XV.—Wheat; selected seed.

Serial No. of experiment.	No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over standard plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
										Actual.		Percentage.				
				Crop	Manure.	Crop.	Manure.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.			
			Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.
1	39	1	0·28	Cotton.	Dung and bone dust.	Wheat (haura) pedigree seed.	Dung (160 mds.)	770	1,358	—152	—6	—17	—·43	12 10 1	13 8 7	28 3 3
		2	0·28	Do.	do. ...	Do. ordinary seed.	do. ...	922	1,364	...	...	...	...	12 12 2	13 10 0	32 13 3
2	61	1	0·33	Do.	*Nil.*	Do. (katha) pedigree seed.	*Nil.*	764	1,275	+87	+97	+13	+8	14 4 3	*Nil.*	24 14 2
		2	0·33	Do.	do. ...	Do. ordinary seed.	do. ...	677	1,198	...	...	...	...	14 11 1	do.	22 4 11
		3	0·33	Do.	do. ...	Do. pedigree seed.	do. ...	600	990	—77	—208	—11	—17	14 2 6	do.	19 8 0

The results are discrepant. It was noticed that all the fields in which the pedigree wheat was sown were attacked with rust more severely than those in which ordinary seed was sown; and their outturn was relatively poor for this reason.

The high cultivation of wheat on a small scale for the selection of pedigree seed was continued, but with much poorer results than were obtained in the previous year. The fields were manured with dung and the crop twice weeded by manual labour. Three waterings were given, one before sowing, another after the plants had made some growth, and lastly when the plants were in flower. At the time of the third watering the soil was in an extremely wet condition, and only half of each plot was irrigated, the other half being left unirrigated. The results are given below, compared with the previous year's outturn :—

Crop.	Area of plot.	Outturn per acre.				Remarks.
		Preceding year.		Year under report.		
		Grain.	Straw.	Grain.	Straw.	
	Acre.	lbs.	lbs.	lbs.	lbs.	
Wheat (haura, hard white) ...	0·032	2,272	6,378	992	2,317	Irrigated thrice.
Do. ...	0·032			1,100	3,158	do. twice.
Wheat (pissi, soft white) ...	0·032	1,983	5,700	1,092	3,175	do. thrice.
Do. ...	0·032			525	2,975	do. twice.
Wheat (katha, hard red) ...	0·032	1,844	5,444	1,008	2,400	do. thrice.
Do. ...	0·032			1,025	2,550	do. twice.

29. (7) *The effect of pickling seeds as a preventive against fungoid disease.*—The small non-experimental portions on the sides of field No. 36 (Ville plots) were sown with pickled seed to test the effect of different kinds of pickles in preventing attack of fungoid diseases. Copper sulphate (blue vitriol), carbolic acid and urine and lime were tried both with and without irrigation. The result showed that pickling of seed did not prevent the attack of rust, though it had a decided effect on smut. The wheat crop all over the Farm was attacked here and there with smut, but in the pickled plots not a single case of smutted grain was found.

30. Field No. 29 has been permanently laid down for a rotation experiment, the principal crop in the rotation being wheat. Details of rotations are given in Annexure D. During the year under report all the plots were sown with wheat, and the results are given below. The rotation in plot 5 was not commenced in the year under report.

TABLE XVI. Wheat; rotations.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
			Crop.	Manure.	Crop.	Manure.	Grain.	Straw.			
		Acre.					lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
29	1	0·29	Wheat and linseed.	Dung	Wheat (haura).	*Nil.*	604	1,134	8 5 7	*Nil.*	24 4 9
	2	0·29	Do.	Do.	Do.	Do.	515	1,102	7 14 9	do.	21 3 8
	3	0·29	Do.	Do.	Do.	Do.	537	1,066	8 0 2	do.	21 13 2
	4	0·29	Do.	Do.	Do.	Do.	539	1,087	7 9 10	do.	21 15 7

31. Mention may be made here of the carbon bisulphide experiment for the prevention of weevil attacks, which was continued during the year under report with the following result:—

TABLE XVII. Wheat; use of carbon bisulphide.

No. of *dhola*.	Quantity stored in the *dhola*.	Treatment.	Date of storing the grain.	Date of opening of the *dhola*.	Percentage of weeviled grain.		
					1888-89.	1889-90.	1890-91.
	Mds.						
1	2½	Treatment with carbon bisulphide.	15th May 1890.	Opened twice during the rains before finally opening.	18	9	8
2	Do.	*Nil.*	do.	Do.	25	10	17
3	Do.	Treatment with carbon bisulphide.	do.	Opened in October at the time of sowing the seed.	12	6	8
4	Do.	*Nil.*	do.	Do.	16	7	9

The grain was kept in the same *dholas* (large baskets made of intertwined tur stalks covered over with a layer of earth and dung) that were in use in the preceding two years.

Wheat in two ordinary gunny bags was also treated with the carbon bisulphide.

The bags were charged three times at intervals. The percentage of weeviled grain was 9 in one and 13 in the other.

The cost of charging 2½ maunds of wheat each time came to Re. 0-3-8.

32. LINSEED.—The linseed crop during the year under report unfortunately suffered to a great extent from cloudy weather prevailing at the end of November and the beginning of December.

Almost all the fields were in full flower during the cloudy weather, and most of the flowers withered without producing fruit. This particular affection of the crop is spoken of by cultivators as *miria*, which may perhaps be translated as "blight." The value of the results from an experimental point of view is therefore greatly reduced, and the tables below are given for what they are worth. Fortunately the crop did not suffer much from rust which did not appear till the end of January, by which time the seed was fully formed and ripening.

33. (1). *Manures.*—The result of an experiment on linseed with box-dung and stall-dung is shown below:—

TABLE XVIII. Linseed; various manures.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase (+) or decrease (—) per acre over unmanured plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
									Actual.		Percentage.				
			Crop.	Manure.	Crop.	Manure per acre.	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.			
		Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.
63	1	0·32	Cotton.	*Nil.*	Linseed (haura).	Box-dung (160 mds).	235	674	—56	—107	—19	—14	9 8 10	14 14 10	14 11 9
	2	0·32	do.	do.	do.	*Nil.*	291	781	...	...	...	...	11 3 11	*Nil.*	17 15 7
	3	0·32	do.	do.	do.	Stall-dung (160 mds).	363	935	+72	+154	+24	+20	10 6 4	14 14 10	21 15 8

55290

The discrepancy in the results is due partly to *miria* and partly to another disease called by cultivators *talap*, noticed in the next paragraph.

34. Field No. 57 has been appropriated for linseed rotation. All the plots during the year under report were sown with linseed. The crop suffered from *miria* brought on by the cloudy weather in November, and also to a very great extent from *talap*. The plants in this field, even after the crop had flowered and the capsules formed, began to die one after another in a very unaccountable manner, so much so that at the time of the harvest only about a quarter of the crop was left. The cultivators in the neighbourhood said it was due to *talap* in the soil, but what *talap* was and how it affected the crop they could not explain. As far as I could see there were no signs of any fungoid growth on the plant, and the field was free from white ants. The field was infected with a Euphorbia weed (Euphorbia rothiana) having acrid juice, but the weed was found to some extent in other fields also which did not suffer. The results are given below :—

TABLE XIX. Linseed; rotations.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
			Crop.	Manure.	Crop.	Manure.	Seed.	Stalks.			
		Acre.					lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
57	1	0·28	Cotton.	Bone-dust.	Linseed (baura).	*Nil.*	129	389	7 11 6	*Nil.*	8 2 10
	2	0·28	do.	do.	do.	do.	82	218	7 14 6	do.	5 0 9
	3	0·28	do.	do.	do.	do.	81	289	8 5 11	do.	5 5 9
	4	0·28	do.	do.	do.	do.	99	332	8 3 3	do.	6 7 2

35. (2) *Different varieties of linseed.*—The following table compares the outturn of two varieties of linseed—haura (white) and katha (red). Haura is a better variety and realizes about Rs. 2-8 more per khandi than katha, though katha is generally believed to be hardier and more prolific of the two varieties. The crop in this experiment was sown a few days later than the crops in the two previous experiments and does not appear to have suffered much from the cloudy weather in November :—

TABLE XX. Linseed; varieties.

No. of field.	Sub-plot.	Area.	Treatment in preceding year.		Treatment in year under report.		Outturn per acre.		Increase(+) or decrease(—) per acre over standard plot.				Cost of cultivation per acre.	Cost of manuring per acre.	Value of produce per acre.
									Actual.		Percentage.				
			Crop.	Manure.	Crop.	Manure.	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.			
		Acre.					lbs.	lbs.	lbs.	lbs.			Rs. a. p.	Rs. a. p.	Rs. a. p.
55	1	0·29	Cotton.	Dung.	Linseed. (baura).	*Nil.*	443	949					10 1 2	*Nil.*	26 2 6
	2	0·287	Do.	Do.	Do.	Do.	460	1,093	+1	+4	+0·2	+0·4	9 10 5	Do.	27 11 3
	3	0·283	Do.	Do.	Do.	Do.	409	925					10 5 2	Do.	24 6 4
	4	0·279	Do.	Do.	Linseed. (Katha).	Do.	462	1,042					10 7 3	Do.	24 13 8
	5	0·275	Do.	Do.	Do.	Do.	411	929					10 0 7	Do.	22 1 6

The average outturn of plots 4 and 5 (red variety) has been taken as the standard, with which is compared that of plots 12 and 3 (white variety). The cultivators generally sow both varieties mixed together in varying proportions.

36. The average outturn of wheat and linseed grown on the experimental area is compared with that of preceding years in the following table :—

TABLE XXI.—Wheat and linseed; average outturn.

Crop.	Average outturn of grain per acre in						Outturn of grain per acre in year under report (1890-91).			Remarks.
	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	Maximum.	Minimum.	Average.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Wheat, katha (hard-red).	...	469	615	407	162	330	1,227	443	670	
Wheat, pissi (soft white).	379	426	423	546	70	234	740	616	695	
Wheat, haura (hard white).	580	454	589	466	191	381	1,532	185	727	Including permanent manure series.
	422	409	520	389	165	321	982	185	672	Excluding do.
Linseed ...	215	166	188	161	238	256	462	81	290	

In considering the above figures it should be noted that during the year under report a permanent division has been made of the Farm into experimental and non-experimental area from experience gained in the past as to the quality of the fields, and hence the figures for the year under report are for comparatively good fields only, while in the preceding years no such rigorous exclusion of poor fields was made in calculating the averages.

When rust appeared on the Farm, all the pissi fields at first were entirely free from it for some days, when both the katha and haura were full of it. After a few days the pissi was also attacked, but not so much as haura or katha.

37. In the last report an attempt was made to determine the influence of season on the wheat and linseed crops from tables of rain-fall, and of the average outturn of these crops since 1884-85. The inferences drawn are verified during the year under report. The season was very favourable to wheat, resembling generally that of 1884-85, as will be seen from the table below :—

TABLE XXII.—Wheat and linseed; influence of season.

	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
September ...	14·21	3·57	4·69	8·64	5·75	5·63	13·92
October and first half of November.	0·71	1·61	10·69	6·62	0·61	4·00	2·59
Second half of November and from December to March ...	4·65	4·83	0·63	2·38	0·79	0·26	5·28
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Compare average outturn of wheat (haura) ...	580	454	589	466	191	381	727
Linseed ..	215	166	188	161	238	256	290

The somewhat moderate rain-fall at sowing time (October and 1st half of November) was compensated for by the very heavy fall in September, while the cold weather fall was all that could be desired, and had it not been for rust the outturn of wheat would have been extraordinarily good. For linseed the rain which fell at sowing time was very favourable, and though the cold weather fall was more than was desirable, as most of it occurred at the time when the crop was well advanced, the outturn would have been a full average one, but for the cloudy weather at the time of flowering, and the crop being affected in some fields with *talap*.

38. Rabi crops were grown non-experimentally on an area of 19·43 acres, of which 8·00 acres were under linseed, 4·39 acres under wheat, and 3·85 acres under gram. The outturns were poor, as the land which has been classed as non-experimental is of very inferior quality.

D.—EXPERIMENTS WITH IMPROVED AGRICULTURAL MACHINERY.

39. The project started in 1886-87 of having improved agricultural implements made and introduced through private agency, has, I am sorry, proved a complete failure, owing in most part to the lack of enterprise on the part of the agent employed. There are no doubt many difficulties in the way of the introduction of new implements—the indifference and mistrust of the majority of cultivators when any kind of innovation is concerned, the initial high cost of the implements, the difficulty of repairing the implements properly in villages, &c. But I think that in spite of these difficulties some of the most useful of these implements, such as the Swedish plough, the hand thresher, the winnower and the sugar-cane mills, could, with zeal and perseverance in the work, be gradually introduced with great advantage among the richer land-holders.

40. The results of the trials made with the different kinds of sugarcane mills are tabulated below :—

TABLE XXIII.—Implements; sugar-cane mills.

Kind of mill.	Price of the mill.	Labour employed.	Quantity of canes crushed per hour.			Percentage of juice obtained.		
			1888-89.	1889-90.	1890-91.	1888-89.	1889-90.	1890-91.
	Rs. a. p.		lbs.	lbs.	lbs.			
Bihia three-roller mill...	128 0 0	2 men and 2 bullocks	211	184	187	65	63	68
Bihia two-roller mill ...	50 0 0	Do.	...	133	150	...	60	64
Roger's steel mill ...	95 0 0	Do.	200	131	162	61	59	66

41. Comparative trials of the work of the Swedish plough and the country *nagar* were made during the year under report. The fields were ploughed up immediately after the kharif harvest at the end of November. The soil was in a fairly good condition for ploughing.

TABLE XXIV.—Implements; Ploughs.

Kind of plough.	Cost at Nagpur.	Labour employed.	Time taken to plough an acre.	Cost of one ploughing per acre.
	Rs. a. p.		Hours.	Rs. a. p.
Swedish plough ...	22 0 0	A pair of strong bullocks and one man.	11·51	1 3 2
Country nagar ...	6 0 0	Do.	13·16	1 5 11

Considering that one ploughing with the country nagar is not sufficient to bring the soil in the same condition as when ploughed by the Swedish plough, and that the soil requires to be cross ploughed by the nagar, the cost of ploughing by the nagar is more than double that by the Swedish plough. Against this must be put the higher price of the Swedish plough and the difficulty of ploughing by the Swedish plough with weak and small sized bullocks. On the whole, however, the Swedish plough is cheaper in the end, and the work is more thoroughly done as the soil is inverted. With regard to the latter point there is a considerable difference of opinion, but with all due deference to such high authorities as Dr. Voelcker and Professor Wallace, I think that the work done by the Swedish plough is better and cheaper than that done by the nagar, provided the ploughing is done at the proper time. The Swedish plough is also specially useful for breaking up new land.

42. The results of the comparative trials with threshing machines are given below :—

TABLE XXV.—Implements; threshing machines.

Kind of thresher.	Cost of the machine.		Quantity of sheaves of wheat threshed.	Labour employed.			Time taken to thresh 805 lbs. of sheaves.	Quantity of clean grain threshed.	Quantity of sheaves threshed per hour.	Cost of threshing 805 lbs. of sheaves.
	Price.	Freight.		Bullocks.	Men.	Women.				
	Rs. a.	Rs. a.	lbs.				H. m. s.	lbs.	lbs.	Rs. a. p.
Mayfurth's Hand thresher.	84 6	43 0	805	...	5	2	0 49 11	293	982	0 1 8
Heebner's Little Giant bullock power thresher and cleaner.	*250 0	187 9	805	3	4	3	0 52 15	319	924	0 3 5
Ransome's bullock power thresher.	Not known.		805	3	4	2	1 15 19	266	641	0 4 3
Country method of threshing by bullock treading.	*Nil.*		805	4	2	...	6 28 45	255	124	1 5 7

* The cost of the gear required to work the machine is not included.

In my opinion the hand thresher is the best of all the machines when manual labour could be obtained, not only because it does the work much cheaper than the others, but also because it is a strong, simple, portable machine, and its cost price is not great.

The Little Giant not only threshes but winnows the grain; it is however a cumbersome and rather a weak machine and soon gets out of order, so that after use for a few years it does not clean the grain properly, and the grain has to be passed through the winnower.

Ransome's thresher is a strong compact machine, and does the work exceedingly well.

There is no doubt about the superiority of these machines over the ordinary method of bullock treading, as the work is done much more expeditiously, and if sufficient work be given to them in the season, they will do the work much more cheaply, even allowing for interest and depreciation.

43. The Dell's Winnower has continued to give great satisfaction. Its cost is Rs. 264-3-0 including freight, but with some modifications to simplify it, it can be made locally for about Rs. 70. Two men and two women are required to work it. 1,282 lbs. of chaff were winnowed in one hour, giving 569 lbs. of clean grain at a cost of one anna for the labour.

44. A new water lift—the Steel drum water lift—for drawing water by means of the well bucket was tried during the year under report. The lift is so constructed that after the bullock has drawn up the bucket by turning round horizontally a drum around which the bucket ropes are wound, he stands still, while the bucket is allowed to run down into the well by its own weight, unwinding the drum. The weak point in the lift is the brake which is to be applied to the drum to check its speed when the bucket is being let down. If the brake is not properly applied, the bucket falls with such a great velocity that there is danger of the whole thing being smashed up. With some modifications the lift was worked for some days with one strong bullock and one man, but it cannot be said to be quite successful yet. The cost of making the lift was about Rs. 80. The quantity of water raised from a depth of 25 feet was about 200 c. ft. per hour.

45. Trials were made with two hand pumps obtained from Messrs Richardson & Cruddas Bombay. They worked as satisfactorily as the Hayward and Tyler's hand pumps tried in 1888-89. One draws water from a depth of 60′ and the other from 25′. The cost of the first is Rs. 127 and of the latter Rs. 23. They can be worked by one man and are useful for drawing water for household purposes. Small gardens can also be irrigated with them.

E.—SEWAGE FARM.

46. The area leased out to the tenants of the Sewage Farm during the year was 25 acres, the rent paid by them being at the rate of Rs. 22-8 per acre, besides the water rate, which was 8 annas per each watering per acre. The complaint about the deficiency of sewage was overcome by carting more sewage into the pits, but the difficulty about irrigation increases year by year. The supply of water now in the hot weather is very deficient, and the crops suffered a good deal, some of them being partially destroyed, as water could not be given to them even after an interval of 15 days.

F.—AGRICULTURAL TRAINING.

47. The following is an excerpt from the report on the working of the Agricultural Class which is attached to the Farm, for the year 1890-91 :—

During the year under report a small building costing Rs. 1,240 was built for the accommodation of the Normal Agricultural Class, which was sanctioned by the Chief Commissioner in Government Resolution, General Department, No. 7134-692, dated the 10th November 1890, for the purpose of training Village Schoolmasters in the proper method of teaching Fuller's Agricultural Primer, which has been introduced as a compulsory subject in all the Central Provinces rural schools, and an optional one in urban schools. The work of the class will begin from June 1891. Two batches, each consisting of 36 masters, will be trained every year. The first batch from June to October, and the second from November to March.

There was a great increase in the number of new students who joined the class at the commencement of the year under report.

There was hardly room in the class at first for all those who joined. But the number gradually fell off, and the average number of the first year students during the year under report was 25, of whom 22 remained to the end of the year. It is very satisfactory to note that of these 22 students only 9 were residents of Nagpur, and the remaining 13 came from other parts of the Provinces. It was found necessary to rent a boarding house in Sitabaldi, not far from the class, for the students who came from other districts. It was occupied by 8 students throughout the year.

The 7 students who had passed in the first year's course last year commenced the second year's course, and they were joined by 3 of the students who had failed in the last final examination. The average number in the Senior Class during the year under report was 9, but only 7 presented themselves for the final examination, at the end of the year—the students who had recommenced the second year's course having left the class in the meantime for service.

It gives me pleasure to say that much interest was taken by most of the students in practical work. The Juniors practised at ploughing and bakharing all throughout the rainy season, and at the end of the rains sowed their rabi crops on the plots allotted to them. The Seniors as usual sowed both the kharif and rabi crops on their plots. Some of the students' plots had as fine crops on them as any in the neighbourhood grown by cultivators. Others were not so good, as some of the plots were perfectly water-logged in the rainy season, preventing proper cultivation and weeding, and most of them are entirely overrun with weeds. Besides, great difficulty was experienced in getting bullocks from the Experimental Farm at the proper time. To these difficulties was added that of cattle trespasses, the cattle entirely destroying crops on about two acres and a half out of the total thirteen acres and a quarter sown by the students.

Of the total area sown by the students, *viz.* 13¼ acres, the Seniors had sown ¼ acre with popat and peas, ½ acre with linseed, 1 acre with til, and 1¼ acres each with cotton, juar, wheat and gram, making 7½ acres in all. The Juniors had ½ acre under linseed, 2½ acres under gram, and 3 acres under wheat—in all 6 acres. The money realised by the sale of the crops was about Rs. 80.

A small plot of ground near the class was set apart for the students for practical gardening, and great interest was taken by the students in this work, more perhaps than in practical agriculture. The produce they consumed themselves.

The class was visited during the year by Dr. J. Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society of England, and by C. Benson, Esq., M. R. A. C., Assistant Director of Land Records and Agriculture, Madras Presidency. The following is an extract from a note recorded by Dr. Voelcker :—

"I must express my pleasure and satisfaction in seeing this, the, in my opinion, best Agricultural Class I have met with in my Indian journeys. I have little doubt that a very great measure of the success attending the class is due to the fact that Mr. Fuller insists upon every student doing the practical work of a farm with his own hands. The assigning to every student of a plot of fair size which he is to cultivate himself, and the giving to him of the crops grown, must act as a useful incentive; and hampered though this part of the work is by the difficulty in procuring oxen and labour just when required, I was well pleased with the signs of diligence shown.

"The museum, laboratory, &c., are at present on a small scale only, but are begun well, and I was pleased to see how careful a selection both of specimens and of books had been made. All was in miniature, but all good.

"The teaching impressed me favourably; those in charge of it being evidently intelligent, well trained men. The course of instruction is capital, and has the great merit of not being hampered with too many subjects. Agriculture is the subject kept in view, and the students are not troubled, all through their training, with subjects, such as mathematics, not directly bearing on the main one."

Mr. Benson remarks in the Visitors Book of the class :—

"I have been impressed by the general lines adopted for the practical training of the students, and hope to see a somewhat similar system adopted in Madras in the Farm schools to be adopted there. The allotment of separate plots to the students for their personal cultivation seems to be a very efficient plan, and must give them the familiarity with the manual work of the field necessary to the proper management of farm labour."

The annual (first year) and final (second year) examinations were held in the 2nd fortnight of March 1891. Many thanks are due to the gentlemen mentioned below for kindly undertaking to examine in the several subjects :—

Subject.	Examiners.
Agriculture (theory), and elementary Veterinary	J. B. Fuller, Esq., C. S., Commissioner of Settlements and Agriculture.
Chemistry (theory), Botany, Geology ...	Dr. Alex. Robertson, M. B., Professor, Hislop College.
Chemistry, practical ...	R. H. Craddock, Esq., C. S., Settlement Officer, Nagpur.
Surveying (theory), Surveying (practical) ..	J. R. Scott, Esq., Assistant Settlement Officer, Nagpur.
Drawing ...	Mr. Sitaram Vishwanath, Drawing Master, Training Institution, Nagpur.
Agriculture (practical) ...	Superintendent, Experimental Farm, Nagpur.

Of the 22 Junior and 7 Senior students, 15 of the former and 6 of the latter passed the prescribed standard Of the 6 students who passed the final examination, one, T. Gopalswamy, was granted a First Class certificate, being a Matriculated student. He also succeeded in obtaining the Fuller Silver Medal, which Mr. Fuller kindly grants every year to the senior student who stands first on the class list. The remaining 5 were granted Second Class certificates. In forwarding the results of the examinations, Dr. Robertson writes :—

"I consider the answers to be distinctly better this year. You have good reason to be pleased with the work done."

Mr. Craddock remarks :—

"They all seemed to handle the reagents with familiarity, and they are well up in the memory part of the work, that is to say, they remember that certain reagents give certain results, and what conclusions must be drawn from them.

"Several of them were made to handle appliances and explain experiments themselves, and I am satisfied that they have all been well taught how to do this. Even the worst of them showed intelligence when called upon to do something practically with his own hands. They nearly all know how to prepare the gases named in their syllabus of practical work, and how to find out lime in soils.

"To sum up generally, I think the boys know as much of their subject as ordinary English boys would after a year's study with equal time given to the work, when due allowance is made for the fact that they have to learn for the most part in a foreign language; and taking into consideration this fact, as well as the fact that the material is rather rough, I think the Principal and Mr. Joshi may be congratulated on the results obtained."

The students were regularly exercised on the horizontal and parallel bars once or twice a week under the superintendence of Mr. Joshi.

The total expenditure during the year under report was Rs. 2,650-7-0; the cost of training each student was Rs. 77-15-3.

48. During the year under report a small Veterinary Dispensary for out-patients was opened in connection with the Agricultural Class, chiefly with a view to give to the students of the class some practical training.

The dispensary building was completed in April 1890, but it was not before September 1890 that the necessary drugs and instruments were got. The number of animals treated between September and the end of March was 160, but I am glad to be able to say that the dispensary is gaining in popularity under the present Veterinary Inspector in charge (Mr. Chitambram Pillay), and that I shall be able to record much better results in my report for the current year. No charge is made for medicines for animals whose owners are not in a position to pay, and a very nominal charge—not exceeding two annas a day—is made for animals whose owners can afford to pay.

49. It is a part of the duties of the Veterinary Inspector to go on tours in the district when any outbreak of cattle disease occurs, to instruct the people how to treat the animals on rational principles. In the year under report 4 tours were made by the Inspector, but being unsupplied with the necessary medicines, instruments and appliances, he was not able to do much good. A scheme of travelling dispensaries has lately been devised by the Commissioner of Settlements and Agriculture, in consultation with the late Dr. J. H. Steel, Principal, Veterinary College, Bombay, and in future the Inspector will carry with him on his tours Veterinary Travelling Chests containing all the necessary things for a fortnight's tour, for the treatment of about 300 animals.

The expenditure and receipts for the year under report were Rs. 337-15-7 and Rs. 25-3-6, respectively.

G.—FINANCIAL RESULTS.

50. The expenditure and receipts of the Farm during the year under report are shown below :—

	Expenditure.			Receipts.	Net cost.
	Salaries.	Contingencies.	Total.		
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Budget ...	4,764 0 0	4,236 0 0	9,000 0 0	1,700 0 0	7,300 0 0
Actual ...	4,534 7 5	4,114 13 11	8,649 5 4	1,986 0 3	6,663 5 1

H.—GENERAL.

51. During the year under report the Farm was visited by Dr. A. Voelcker and Mr. C. Benson, M. R. A. C., Assistant Director of Agriculture, Madras. In a note published by Dr. Voelcker on the Farm, he writes :—

"With the Farm, as an Experimental Farm, I was on the whole very well pleased, and with certain re-arrangement, which I have suggested, it is likely to prove a capital Experimental Station. The position is good, the land level, the plots of suitable size, the soil, as far as I could judge, of similar character throughout, and the plan of experiment well laid out in many respects, a definite object being, as a rule, set in view.

"Added to this, the cultivation of the fields, the cleaning of the land, and the accuracy and faithful recording of results, struck me as leaving nothing to be desired.

"The main defects are, in may opinion, a desire to obtain a large number of results, and to this end utilising the same result several times over when the comparison may not be fully justified ; the want of duplication of experiment both by repetition in a succeeding as well as by duplicate plots in the same year, especially of unmanured plots ; the drawing of conclusions from results where, owing to anomalies, it would be well to postpone judgment ; and lastly, in some few experiments, a want of any connection between the different kinds of manures tried, so that issues are complicated and no real knowledge is gained.

"These remarks, I may say, are applicable in quite as great measure to experiments at other Indian Experimental Stations."

52. I much regret the delay which has occurred in the submission of this report. The delay was due to the calculations of the cost of cultivation, &c., being not ready till August 10th, as the work was new to the clerk and involved an immense amount of calculation.

53. The usual comparative record of experiments is appended (Annexure E).

I have the honour to be,

Sir,

Your most obedient Servant,

C. D. MAHALAXMIVALA,

Superintendent, Government Experimental Farm,

Nagpur.

LIST OF ANNEXURES.

A.—Statement showing the rates used for calculating cost of cultivation on the Experimental farm, Nagpur, during 1890-91.

B.—Statement showing the rates used for valuing the produce of the Experimental Farm, Nagpur, during 1890-91.

C.—Details of Total Area under Cultivation.

D.—Programme of permanent Experiments.

E.—Comparative Record of experiments made.

Annexure A.

Statement showing the rates used for calculating cost of cultivation on the Experimental Farm, Nagpur, during the year 1890-91.

[NOTE.—The hire of a pair of bullocks is taken as 12 annas, of a male cooly 3 annas, of a female cooly 1½ annas and of a child 1 anna.]

Class of operation.	Detail.	Rate per acre. Rs.	a.	p.	Explanation.
Cost of tillage.	Ploughing by Swedish plough ...	1	10	5	A pair of bullocks and a man for 1·76 days.
	Hoeing by bakhar (bullock hoe) ...	0	13	9	Do. for ·91 day.
	Weed hoeing by daura (small bullock weeding hoe) ...	0	5	0	Do. and 2 men for ·30 day.
	Do. by dundia (large do.) ...	0	6	3	Do for ·34 day.
	Weeding by hand ...	1	6	0	14 women and 1 child for a day.
Cost of sowing including cost of seed.	Cotton by argarha (country drill hoe) ...	0	10	9	16 lbs of seed (Re. 0-4-0). A pair of bullocks and a man and 3 women for ·34 day.
	Tur do. (do.) ...	0	13	2	12 lbs. of seed (Re. 0-4-10) do. for ·42 day.
	Guar by tifan (country drill) ...	1	1	5	7½ lbs. of seed (Re. 0-5-8). A pair of bullocks and 2 men for ·64 day.
	Covering juar by phasate (bush harrow).	0	3	6	A pair of bullocks and a man for ·23 day.
	Gram by nari nagar (drill plough) ...	1	3	2	18 lbs. of seed (Re. 0-7-7). A pair of bullocks and 2 men for ·67 day.
	Linseed by tifan (country drill) ...	1	0	4	10 lbs. of seed (Re. 0-10-0). 2 pairs of bullocks and 3 men for ·19 day.
	Wheat do. (do.) ...	2	15	3	60 lbs. of seed (Re. 1-14-0) do. for ·52 day.
Cost of manure (excluding carting, loading and spreading).	Saltpetre	30	0	0	240 lbs. @ Rs. 10-0-0 per maund.
	Bone-dust	3	6	0	360 lbs., cost of collecting Re. 0-8-0 per maund and of crushing Re. 0-4-0 a maund.
	Cattle dung	10	0	0	160 maunds @ Re. 0-1-0 per maund of 80 lbs.
	Ashes of dung	10	8	4	*160 maunds dung @ Re. 0-1-0 per maund and drying and burning dung for ashes Re. 0-8-4 per acre.
	Green soiling with san hemp ...	9	8	6	100 lbs. of seed Re. 1-15-8, sowing Re. 0-1-8 and covering seed by harrow Re. 0-8-4 and cutting and ploughing Rs. 6-14-10.
	Do. with tarota (Cassia auriculata ...	7	10	9	Cutting and carting tarota Rs. 2-9-8 and ploughing Rs. 5-1-1.
Cost of harvesting.	Picking cotton	0	4	6	3 women for a day—each picking.
	Reaping juar	0	10	6	7 do.
	Do. gram	0	9	0	6 do.
	Do. linseed	0	7	6	5 do.
	Do. wheat	0	9	0	6 do.
Cost of threshing and cleaning.	Ginning cotton (by country hand charki)	1	12	6	19 women for a day—average produce per acre 214 lbs. seed cotton.
	Threshing and cleaning juar ...	0	12	0	3 men and 2 women for a day—average produce per acre 201 lbs. grain and 1,885 lbs. karbi.
	Do. gram	0	5	1	5 men and 2 women for ·28 day—do. grain 122 lbs. and straw 192 lbs.
	Do. linseed	1	3	3	3 bullocks, 5 men and 4 women for ·49 day—do. grain 289 lbs. and straw 726 lbs.
	Do. wheat	1	2	0	Do. for ·46 day—do. grain 734 lbs. and straw 1,283 lbs.

* Properly speaking the cost of ashes of dung should be much less than the cost of dung, as the dung can be used for fuel in the form of cakes and the ashes afterwards used as manure as waste product, as is generally done.

Annexure B.

Statement showing the rates used for valuing the produce of the Experimental Farm, Nagpur, during the year 1890-91.

Name of produce.	Value.		Remarks.
	Rate.	Per.	
	Rs. a. p.		
Cotton ... Lint ...	79 0 0	Bojha of 345 lbs.	1st Class.
	70 0 0	Do.	2nd „
	50 0 0	Do.	3rd „
„ Seed ...	7 6 0	Khandi of 640 lbs.	
Juar ... Grain ...	7 8 0	Khandi of 390 lbs.	
Karbi ...	48 0 0	Sheaves 1,000	About 7,750 lbs.
Tur ... Grain ...	8 0 0	Khandi of 428 lbs.	
Stalks ...	1 0 0	8 bundles.	About 560 lbs.
Chaff ...	2 6 3	One cart load.	About 478 lbs.
Gram ... Grain ...	10 0 0	Khandi of 380 lbs.	
Chaff ...	2 6 3	One cart load.	About 478 lbs.
Linseed (haura) ... Grain ...	20 8 0	Khandi of 425 lbs.	
Stalks ...	1 0 9	One cart load.	About 478 lbs.
Bhusa ...	3 3 0	One cart load.	About 478 lbs.
Linseed (katha) ... Grain ...	18 0 0	Khundi of 425 lbs.	
Stalks ...	1 0 9	One cart load.	About 478 lbs.
Bhusa ...	3 3 0	One cart load.	About 478 lbs.
Wheat (haura) ... Good grain ...	13 0 0	Khandi of 400 lbs.	
Rusted do. ...	12 0 0		
Do. (katha) ... Good grain ...	11 0 0	Do.	
Rusted grain ...	10 8 0		
Do. (pissi) ... Good grain ...	12 0 0	Do.	
Wheat straw ...	1 13 0	One cart load.	About 478 lbs.

Annexure C.

Total Area under cultivation on the Experimental Farm, Nagpur, during the year 1890-91.

Crop.	Area.	Total.	Grand Total.
	Acres.	Acres.	Acres.
A. EXPERIMENTAL AREA.			
(1). *Kharif.*—			
Cotton alone	5·43		
Cotton and tur	1·12		
Cotton and juar	0·34		
Juar	2·18		
		9·07	
(2). *Rabi.*—			
Wheat	11·62		
Wheat and gram mixed	0·21		
Linseed	3·49		
Cold weather Chanda jari cotton ...	0·32		
		15·64	24·71
B. NON-EXPERIMENTAL AREA.			
(1). *Kharif.*—			
Juar and tur mixed	1·35		
Juar for seed	0·99		
Juar for fodder	5·56		
Sorgho for fodder	0·91		
Tur	4·95		
Kodon	1·25		
Popat	1·53		
Castor	1·57		
Mote	0·43		
Mung	0·26		
Urd	0·56		
Til	0·77		
Guinea grass	0·18		
		20·31	
(2). *Rabi.*—			
Gram	3·85		
Linseed	8·00		
Wheat	4·39		
Mung	0·26		
Urd	0·56		
Til	2·37		
		19·43	39·74
			64·45

Annexure D.

EXPERIMENTAL FARM, NAGPUR.

Programme of Permanent Experiments.

Serial No. of experiment.	No. of field.	Purpose of experiment.	Crop.			Special treatment.			Year of starting experiment.	Remarks.
			1st year.	2nd year.	3rd year.	1st year.	2nd year.	3rd year.		
1	21—1	Effect of tillage to various depths.	Wheat.	Wheat.	Wheat.	To be ploughed every year.	To be ploughed every year.	To be ploughed every year.	1890-91.	Cropping and treatment similar every year.
	—2		do.	do.	do.	To be bakhared only every year.	To be bakhared only every year	To be bakhared only every year.		
	—3		do.	do.	do.	To be ploughed every third year	To be ploughed every third year.	To be ploughed every third year		
2	41	Effect of embanking rabi fields when manure is used.	do.	do.	do.	Dung.	Dung.	Dung.	1885-86.	There is no unembanked duplicate for comparison, but there are numerous other fields with which a comparison can fairly be made.
3	43	Effect of embanking rabi fields without using manure.	do.	do.	do.	Nil.	Nil.	Nil	1885-86.	To compare with No. 2.
4	22—1	Effect of mixing crops—the principal one being cotton.	Jari cotton.	Jari cotton.	Jari cotton.	do.	do.	do.	1891-92.	Cropping similar every year; manure to be applied occasionally.
	—2		Jari cotton and tur in the proportion of 6 lines to 2.	Jari cotton and tur in the proportion of 6 lines to 2.	Jari cotton and tur in the proportion of 6 lines to 2.	do.	do.	do.		
	—3		Jari cotton and juar in the proportion of 6 lines to 2.	Jari cotton and juar in the proportion of 6 lines to 2.	Jari cotton and juar in the proportion of 6 lines to 2.	do.	do.	do.		
5	25—1	Effect of mixing crops—wheat and a leguminous crop (gram.)	Wheat.	Wheat.	Wheat.	do.	do.	do.	1890-91.	Ditto.
	—2		Wheat-gram.	Wheat-gram.	Wheat-gram.	do.	do.	do.		

Programme of Permanent Experiments.—(Contd.)

Serial No. of experiment.	No. of field.	Purpose of experiment.	Crop. 1st year.	Crop. 2nd year.	Crop. 3rd year.	Special treatment. 1st year.	Special treatment. 2nd year.	Special treatment. 3rd year.	Year of starting experiment.	Remarks.
6	33—1	Effect of rotations with cotton.	Cotton-tur ...	Cotton-tur ...	Cotton-tur ...	Nil. ...	Nil. ...	Nil ...	1890-91.	Two year rotation, *i. e.*, the fourth year will follow the second.
	—2		do. ...	Wheat ...	do. ...	do. ...	do. ...	do. ..		
	—3		do. ...	Gram ...	do. ...	do. ...	do. ...	do. ...		
7	29—1	Effect of rotations with wheat.	Wheat ...	Wheat ...	Wheat ...	do ...	do. ...	do. ...	1890-91.	Two year rotation, *i. e.*, the fourth year will follow the second.
	—2		do. ...	Fallow ...	do. ...	do. ...	do. ...	do. ...		
	—3		do. ...	Gram ...	do. ...	do. ...	do. ...	do. ..		
	—4		do. ...	Juar-tur ..	do. ...	do. ..	do. ...	do. ..		
	—5		do. ...	Kodon ...	do. ...	do. ..	do. ...	do. ...	1891-92.	
8	57—1	Effect of rotations with linseed.	Linseed ...	Linseed ..	Linseed ...	do. ...	do. ...	do. ...	1890-91.	Two year rotation, *i. e.*, the fourth year will follow the second.
	—2		do. ...	Gram ...	do. ...	do. ...	do. ...	do. ..		
	—3		do. ...	Cotton ...	do. ...	do. ...	do. ...	do. ..		
	—4		do. ...	Tur ...	do. ...	do. ...	do. ...	do. ..		
9	14—1	Effect of green soiling with *san* hemp. —on wheat with fallow interposed	Fallow ...	Wheat ..	Fallow ...	Green soiling with *san* hemp.	Nil ...	Green soiling with *san* hemp.	1891-92.	Cropping and treatment similar every other year.
	—2		do. ...	do. ..	do. ...	Nil.	do. ...	Nil ..		
	—3	—on wheat in rotation with cotton.	Wheat ...	Cotton ...	Wheat ...	Green soiling with *san* hemp.	Nil ...	Green soiling with *san* hemp.	1891-92.	Do. do.
	—4		do. ...	do. ...	do. ...	Nil.	do. ...	Nil ...		
10	17—1	Effect of green soiling with wild indigo on wheat and cotton in rotation.	Wheat ...	Cotton ..	Wheat ...	Green soiling with wild indigo.	Nil ...	Green soiling with wild indigo.	1890-91.	Do. do.
	—2		do. ...	do. ...	do. ...	Nil.	do. ...	Nil ..		
11	32—1	Effect of green soiling with wild indigo on wheat.	Wheat ...	Wheat ...	Wheat ...	Green soiling with wild indigo.	Green soiling with wild indigo	Green soiling with wild indigo	1891-92.	Do. every year. NOTE.—It is possible that this field may be irrigated.
	—2		do. ...	do. ..	do. ...	Nil.	Nil ...	Nil ..		
12	18—1	Relative effect of green soiling, box dung and stall dung.	Wheat ...	Wheat ...	Wheat ...	Hemp ...	Hemp ...	Hemp ..	1890-91.	Cropping and treatment similar every year.
	—2		do. ...	do. ...	do. ...	Nil.	Nil ...	Nil ...		
	—3		do. ...	do. ...	do. ...	Box dung ...	Box dung ...	Box dung ...		
	—4		do. ...	do. ...	do. ...	Stall dung ...	Stall dung ...	Stall dung ...		

13	44—1	Relative effect on cotton and wheat in rotation of box dung, stall dung and bone-dust.	Cotton	Wheat	As for 1st year.	Stall dung	Stall dung	Stall dung	1890-91.	Manures continued every year; crops to be in rotation.
	—2		do.	do.		Box dung	Box dung	Box dung		
	—3		do.	do.		Nil	Nil	Nil		
	—4		do.	do.		Bone-dust	Bone-dust	Bone-dust		
14	53—1	Relative effect on linseed and cotton in rotation of box dung and stall dung applied in alternate years only.	Linseed	Cotton		Box dung	Nil	Box dung	1890-91.	To be manured with the same kinds of manures every alternate year and crops to be in rotation.
	—2		do.	do.		Nil	do.	Nil		
	—3		do.	do.		Stall dung	do.	Stall dung		
15	62—1	Relative effect of dung and bone-dust applied each year on juar and linseed grown in rotation.	Juar	Linseed		Dung	Dung	Dung	1890-91.	Manures continued every year; crops to be in rotation.
	—2		do.	do.		Nil	Nil	Nil		
	—3		do.	do.		Bone-dust	Bone-dust	Bone-dust		
16	65—1	Effect of liming soils	Wheat	Cotton		Caustic lime	Nil	Nil	1890-91.	No. 1 was limed in 1890-91, and another application of lime to be made after 12 years. The crops to be in rotation and manures especially organic ones to be applied to both the plots equally occasionally.
	—2		do.	do.		Nil	do.	do.		
17	68—1	Effect on wheat of manuring and top dressing with saltpetre.	Wheat	Wheat	Wheat	Nil	Nil	Nil	1891-92.	
	—2		do.	do.	do.	Saltpetre drilled in with seed 240 lbs. per acre.	Saltpetre drilled in with seed 240 lbs. per acre.	Saltpetre drilled in with seed 240 lbs. per acre.	1890-91.	To be irrigated. Cropping and treatment similar every year.
	—3		do.	do.	do.	Saltpetre top dressing 80 lbs per acre.	Saltpetre top dressing 80 lbs per acre.	Saltpetre top dressing 80 lbs. per acre.		
18	A—1	Effect on wheat grown continuously of different kinds of manures applied year after year without irrigation.	Wheat	Wheat	Wheat	Saltpetre	Same as in first year.	Same as in first year.	1883-84.	Cropping and treatment similar every year. *Quantities per acre.* Saltpetre ... 240 lbs. Bone-dust... 360 „ Cattle dung. 160 mds. Ashes of ... 160 mds. dung.
	—2		do.	do.	do.	Bone-dust				
	—3		do.	do.	do.	Saltpetre and bone-dust				
	—4		do.	do.	do.	Cattle dung				
	—5		do.	do.	do.	Dung and bone-dust.				
	—6		do.	do.	do.	Ashes of dung...				
	—7		do.	do.	do.	Nil				
	—8		do.	do.	do.	San hemp ploughed in green.				

Programme of Permanent Experiments.—(Concluded).

Serial No. of experiment.	No. of field.	Purpose of experiment.	Crop. 1st year.	Crop. 2nd year.	Crop. 3rd year.	Special treatment. 1st year.	Special treatment. 2nd year.	Special treatment. 3rd year.	Year of starting experiment.	Remarks.
19	B—1	Effect on wheat grown continuously of different kinds of manures applied year after year with irrigation.	Wheat ...	Wheat ...	Wheat ...	Saltpetre ...	As in first year.	As in first year.	1890-91.	To be irrigated. Cropping and treatment similar every year. *Quantities per acre*, as for Series A.
	—2		do. ...	do. ...	do. ...	Bone-dust ...				
	—3		do. ...	do. ...	do. ...	Saltpetre and bone-dust.				
	—4		do. ...	do. ...	do. ...	Cattle dung ...				
	—5		do. ...	do. ...	do. ...	Dung and bone-dust.				
	—6		do. ...	do. ...	do. ...	Ashes of dung Nil ...				
	—7		do. ...	do. ...	do. ...	San hemp ploughed in green.				
	—8									
20	C—1	Effect on wheat of different kinds of manures applied in rotation with a kharif leguminous crop.	Wheat ..	Tur ...	Wheat ...	Saltpetre ...	Nil ...	Saltpetre ...	1891-92.	To be manured with the same kinds of manure every alternate year and crops to be in rotation. *Quantities per acre*, as for Series A.
	—2		do. ..	do. ..	do. ...	Bone-dust ...	do. ...	Bone dust ...		
	—3		do. ..	do. ...	do. ...	Saltpetre and bone-dust.	do. ...	Saltpetre and bone-dust.		
	—4		do. ..	do. ...	do. ...	Cattle dung ...	do. ..	Cattle dung ...		
	—5		do. ...	do. ...	do. ...	Dung and bone-dust.	do. ...	Dung and bone-dust.		
	—6		do. ...	do. ...	do. ...	Ashes of dung Nil. ...	do. ...	Ashes of dung.. Nil. ..		
	—7		do. ...	do. ...	do. ...	San hemp ploughed in green.	do. ...	San hemp ploughed in grass.		
	—8									
21	Ville-1	Practical method of soil analysis by using chemical manures, as devised by M. Georges Ville.	Wheat ..	Wheat ...	Wheat ...	Amm. Chlor. Cal. Superphosp.: Pot Sulph.: Cal Sulph.	As in first year.	As in first year.	1890-91.	Cropping and treatment similar every year and the crop to be irrigated. *Quantities per acre.* Ammonic Chloride 140 lbs. Calcic Superphosphate 180 „ Potassic Sulphate 90 „ Calcic Sulphate 100 „
	—2		do. ...	do. ...	do. ...	As in I less Cal. Superphosph.				
	—3		do. ...	do. ...	do. ...	As in I less Amm. Chlor:				
	—4		do. ...	do. ...	do. ...	No manure.				
	—5		do. ...	do. ...	do. ...	As in I less Potassic Sulphate				
	—6		do. ...	do. ...	do. ...	As in I less Calcic Sulphate				

Annexure E.

Comparative Record of experiments made on the Experimental Farm, Nagpur, during the year ending 31*st March* 1891.

Serial No.	Object of experiment.	No. of field.	Sub-plot.	Area of sub-plot.	Crop grown.	Special treatment.	Outturn per acre.		Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment.		Cost per acre.			Value of produce per acre.	Remarks.
							Lint or grain.	Seed or straw.	Lint or grain.	Seed or straw.	Manure.	Special treatment.	Cost of cultivation excluding manure & special treatment.		
				Acres.		*(A) Cotton.*	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	To test the effect of previous year's green soiling with san hemp.	14	1	0·19	Cotton Upland Georgian.	Nil. ...	89	205	...	...	Nil.	Nil.	11 6 10	22 12 6	Average outturn of plots 3 and 4 is compared with that of plots 1 & 2.
			2	0·19			93	214	...	...			11 10 5	23 12 8	
			3	0·19		Nil (Green soiled with san hemp in the previous year.)	127	298	+43	+40			12 9 3	32 9 1	
			4	0·19			132	290					12 3 2	33 9 11	
2	To test the effect of stall dung, box dung and bone dust.	44	1	0·38	Cotton, Nagpur Jari.	Stall dung (160 maunds per acre.)	46	69	+9	+1	11 8 3	Nil.	7 2 6	7 6 6	A poor field.
			2	0·38		Box dung (160 maunds per acre.)	59	88	+40	+29	11 8 3		7 0 6	9 8 1	
			3	0·38		Nil. ...	42	68			Nil.		7 9 1	6 14 1	
			4	0·38		Bone dust (360 lbs. per acre) ...	43	69	+2	+1	4 12 0		6 10 2	6 15 5	
3	To test the effect of preparing cotton seed for sowing with acid against country method.	44	1 A.	0·19	Cotton, Nagpur Jari.	Seed prepared with acid ...	35	55	—37	—24	11 8 3	*0 7 4	6 10 6	5 11 4	*Cost of seed preparation.
			1 B.	0·19		Seed prepared with dung ...	56	84				0 0 2	7 3 0	9 1 7	
			2 A.	0·19		Seed prepared with acid ...	54	82	—14	—13	11 8 3	0 7 4	6 11 0	8 12 6	For manures applied to the sub plots see experiment No. 2 above.
			2 B.	0·19		Seed prepared with dung ...	63	94				0 0 2	6 14 6	10 3 8	
			3 A.	0·19		Seed prepared with acid ...	36	62	—25	—16	Nil.	0 7 4	7 2 0	5 15 0	
			3 B.	0·19		Seed prepared with dung ...	48	74				0 0 2	7 8 8	7 13 1	
			4 A.	0·19		Seed prepared with acid ...	42	68	—2	—3	4 12 0	0 7 4	6 6 2	6 14 1	
			4 B.	0·19		Seed prepared with dung ...	43	70				0 0 2	6 6 7	7 0 9	
4	To test the comparative outturn of exotic cottons.	15	1 A.	0·13	Cotton—New Orleans.	Dung 160 maunds per acre ...	145	274	...	...	13 1 5	Nil.	10 15 8	37 6 8	Seed obtained from Saharanpur. It was found to contain a large quantity of some indigenous variety.
			1 B.	0·09	Cotton—Lousiana prolific.		120	268	...	...	13 1 5		10 15 8	27 7 10	
			2 A.	0·05	Cotton—Tree Cotton.		104	255	...	...	13 1 5		8 7 10	22 1 8	
			2 B.	0·06	Cotton—Lousiana prolific.		64	146	...	...	13 1 5		8 7 10	15 4 5	
			2 C.	0·07	Cotton—Sea Island.		6	11	...	...	13 1 5		8 7 10	1 5 6	
5	To test the comparative outturn of exotic cottons.	26	1	0·22	Cotton Allen ...	Dung 160 maunds per acre ...	51	117	...	...	12 9 6	Nil.	5 15 0	13 2 3	Seed obtained from Government Experimental Farm, Bhadgaon. It was found to contain a large quantity of some indigenous variety.
			2	0·22	Do. Bruder ...		49	106	...	...	12 9 6		6 0 2	8 5 6	
			3	0·22	Do. Upland ...		62	137	...	...	12 9 6		6 5 1	14 2 11	
			4	0·22	Do. Lousiana ...		62	144	...	...	12 9 6		6 7 0	14 4 3	

Annexure E.—(Contd.)

Serial No.	Object of experiment.	No. of field.	Sub-plot.	Area of sub-plot.	Crop grown.	Special treatment.	Outturn per acre.		Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment.		Cost per acre.			Value of produce per acre.	Remarks.
							Lint or grain.	Seed or straw.	Lint or grain.	Seed or straw.	Manure.	Special treatment.	Cost of cultivation excluding manure & special treatment.		
							lbs.	lbs	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
6	To test the comparative outturn of local cottons.	22	1	0·26	Cotton Bani ...	Nil ...	90	224	+7	+14	Nil.	Nil.	11 11 6	20 14 2	Seed obtained from Hinganghat.
			2	0·26	Do. Jari ...		156	245	+85	+25			11 15 0	25 7 7	
			3	0·26	Do. Upland Georgian.		84	195					10 4 0	21 8 3	Seed obtained from Katol Farm acclimatized seed.
7	To test the comparative outturn of Berar and Nimar cottons.	23	1	0·25	Cotton Dharwadi ...	Nil. ...	23	57			Do.	Nil.	7 2 4	5 5 4	Seed obtained from Government Experimental Farm, Bhadgaon.
			2	0·25	Do. Varadi ...		50	108	+117	+89			7 15 0	8 8 2	
			3	0·25	Do. Nimari ...		47	132	+104	+131			8 4 0	12 4 11	Seed obtained from Khandwa.
8	To test the effect of mixing cotton with tur and juar	37	1	0·34	Cotton bani alone ...	Nil. ...	42	100			Do.	Nil.	4 11 0	9 11 1	A poor field.
			2	0·34	Do. and tur mixed.		Lint 30 Grain 40	Seed 74 Chaff ... Stalks 912	...	...			5 12 8	17 10 9	
			3	0·34	Do. and juar mixed.		Lint 31 Grain 32	Seed 73 Karbi 324					*4 10 9	9 11 7	*Excluding cost of watching juar which came to Rs. 7-5-8 per acre.
9	To test the effect of rotations ...	33	1	0·39	Jari cotton and tur in the proportion of 6 lines to one.	Nil. ...	Lint 32 Grain 396	Seed 49 Chaff 482 Stalks 295	...	...	Do.	Nil.	10 5 2	15 8 9	
			2	0·39			Lint 54 Grain 633	Seed 85 Chaff 779 Stalks 295					11 13 4	25 6 4	
						(B) *Juar.*									
10	To test the effect of dung and bone-dust.	42	1	0·38	Juar.	Dung (160 mds. per acre) ...	229	1,829	+ 45	+ 4	12 13 2	Nil.	3 10 7	15 7 0	Cost of watching the plots Rs. 2-10-1 per acre.
			2	0·38		Nil. ...	158	1,821	...	...	Nil.		4 13 8	14 2 0	
			3	0·38		Bone-dust (360 lbs. per acre) ...	145	1,750	— 8	— 4	3 13 3		5 2 5	13 7 2	
11	To test the comparative yield of different varieties of Central Provinces juar.	38	1	0·06	Juar-Chirola.	Dung (160 mds. per acre).	479	2,500	...	...	14 15 2	Nil.	5 10 3	25 5 2	Seed obtained from Damoh.
			2	0·06	Do. Bansmati.		312	3,733	...	...	14 15 2		5 10 3	29 8 9	Do. do. Saugor.
			3	0·06	Do. Badela.		617	2,983	...	...	14 15 2		6 1 2	31 2 5	Do. do. do.
			4	0·06	Do. Jogan.		317	2,600	...	...	14 15 2		6 1 2	20 15 11	Do. do. Damoh.

(C) *Wheat.*

12	Permanent manure Series A (without irrigation.)	A.	1	0·10	Wheat (haura.)	Saltpetre (240 lbs. per acre) ...	1,227	2,390	+138	+145	30 0 0	Nil.	14 12 8	48 15 2	
			2	0·10		Bone-dust (360 lbs. do.) ...	685	925	+ 33	— 5	3 6 0		14 6 10	25 12 3	
			3	0·10		Saltpetre (240 lbs. do.) and bone-dust (360 lbs. do.) ...	1,360	2,620	+164	+169	33 6 0		15 4 2	54 1 11	
			4	0·10		Cattle dung (160 mds. per acre.)	937	2,072	+ 82	+113	12 0 6		14 3 6	38 5 1	
			5	0·10		Cattle dung (160 mds. do.) and bone-dust (360 lbs. do.) ...	7,550	1,495	+ 47	+ 54	15 6 6		13 15 4	30 3 3	
			6	0·10		Ashes of 160 mds. dung ...	717	1,427	+ 31	+ 47	13 2 10		13 4 6	28 11 6	
			7	0·10		Nil. ...	515	972	...	...	Nil.		13 0 4	20 6 9	
			8	0·10		Green soiling with san hemp ...	760	1,317	+ 47	+ 35	9 8 6		10 6 8	29 11 0	
13	Permanent manure Series B (with irrigation.)	B.	1	0·10	Wheat (haura)	Saltpetre (240 lbs. per acre) ...	1,532	2,662	+ 91	+157	30 0 0	*6 12 9	12 3 10	57 15 7	*Cost of irrigation,
			2	0·10		Bone-dust (360 lbs. per acre) ...	937	1,265	+ 17	+ 22	3 6 0		11 6 6	34 1 5	
			3	0.10		Saltpetre (240 lbs. per acre) and bone-dust (360 lbs. do.) ...	1,502	3,005	+ 87	+189	33 6 0		11 14 10	58 5 4	
			4	0·10		Dung (160 mds. do.) ...	1,037	1,495	+ 29	+ 44	12 0 6		11 14 10	38 1 4	
			5	0·10		Dung (160 mds. do.) and bone-dust (360 lbs. do.) ...	1,035	1,475	+ 29	+ 42	15 6 6		11 10 8	37 14 11	
			6	0·10		Ashes of 160 mds. per acre ...	962	1,050	+ 20	+ 1	13 2 10		11 0 8	34 0 11	
			7	0·10		Nil. ...	802	1,035	...	...	Nil.		10 15 0	28 15 11	
			8	0·10		Green soiling with san hemp ...	925	1,487	+ 15	+ 43	9 8 6		9 13 6	34 8 8	
14	Practical method of soil analysis on Ville system.	36 Ville.			...	Ammonic chloride (140 lbs. per acre.)									The cost of cultivation, &c., is not given as this experiment has no bearing on profit or loss. The plots were all once irrigated from 11th to 13th February 1891.
			1	0·05	...	Superphosphate (180 lbs. do.) ...	1,435	2,845	+ 87	+ 77	.....	.....	...	...	
					...	Potassic sulphate (90 lbs. do.) ...									
					...	Calcic sulphate (100 lbs. do.) ...									
			2	0·05	Wheat (haura).	As in I less superphophate ...	1,270	2,605	+ 66	+ 61	.....	.....	...	...	
			3	0·05	...	Do. ammonic chloride ...	805	1,910	+ 5	+ 18	.....	.....	...	...	
			4	0·05	...	No manure ...	765	1,610	...	...	.....	.....	...	...	
			5	0·05	...	As in I less potassic sulphate ...	1,455	2,920	+ 90	+ 81	.....	.....	...	...	
			6	0·05	...	Do. calcic sulphate ...	1,270	2,865	+ 66	+ 78	.....	.....	...	...	
15	To test the effect of green soiling with tarota or tarwar (cassia auriculata.)	17	1	0·23	Wheat (katha.)	Green soiling with tarota (cassia auriculata.)	665	1,239	+ 50	+ 67	7 10 9	Nil.	12 10 6	22 2 6	
			2	0·23		Nil. ...	443	722	...	...	Nil.		15 3 10	14 5 11	
16	To test the effect of green soiling, box dung and stall dung.	18	1	0·26	Wheat (haura.)	Green soiling with san hemp ...	734	1,185	+ 20	+ 23	10 9 6	Nil.	10 11 9	28 5 7	
			2	0·26		Nil. ...	612	962	...	...	Nil.		14 5 5	23 8 7	
			3	0·26		Box dung (160 mds. per acre) ...	681	1,158	+ 11	+ 20	13 12 11		13 7 4	26 7 5	
			4	0·26		Stall dung (160 mds. do.) ...	837	1,029	+ 37	+ 7	13 12 11		13 10 10	31 0 11	

Annexure E.—(Concluded).

Serial No.	Object of experiment.	No. of field.	Sub-plot.	Area of sub-plot.	Crop grown.	Special treatment.	Outturn per acre. Grain.	Outturn per acre. Straw.	Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment. Lint or grain.	Percentage of increase (+) or decrease (—) in produce resulting from experimental treatment. Seed or straw.	Cost per acre. Manure.	Cost per acre. Special treatment.	Cost per acre. Cost of cultivation excluding manure and special treatment.	Value of produce per acre.	Remarks.
				Acres.		(C.)—*Wheat.*—(Contd).	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
17	To test the effect of top dressing as against manuring with saltpetre drilled in with the seed.	68	1	0·02	Wheat (katha).	Nil.	525	1,075			Nil.	*6 12 9	10 15 0	17 13 8	*Cost of irrigation. Irrigated once.
			2	0·10		Saltpetre (240 lbs. per acre) ...	1,227	3,275	+134	+205	30 0 0		15 6 8	44 9 8	
			3	0·10		do. (80 lbs.) top dressing ...	567	1,135	+8	+6	10 5 0		11 4 10	19 2 11	
18	To test the effect of caustic lime...	65	1	0·46	Wheat (haura).	Caustic lime (3 tons per acre.) ...	647	990	+15	—33	85 5 7	Nil.	11 11 10	23 15 6	Another application of lime will not be necessary for 12 years and hence the cost of manure during the year should be taken as Rs. 7-1-10.
			2	0·49		Nil.	562	1,485	...	...	Nil.		11 2 9	23 3 0	
19	To test the residual effect of poudrette (applied in the previous year.)	59	1	0·31	Wheat (haura).	Nil.	559	941	...	...	Nil.	Nil.	10 7 0	19 10 1	The average of plots 4 and 5 is compared with the average of plots 1 and 2 taken as the unmanured plots. Plot 3 is left out of account as half of it was manured and the other half unmanured last year.
			2	0·31		Nil.	590	1,158	...	...			11 6 6	21 5 6	
			3	0·31		Half Nil and half poudrette (in previous year.)	507	1,680	...	...			10 10 5	20 14 11	
			4	0·31		Poudrette (200 mds. per acre in previous year.)	982	1,511	+50	+47			10 10 2	33 15 3	
			5	0·31			735	1,574					11 4 10	27 1 6	
20	To test the effect of embanking field with and without manure.	41	A.	0·303	Wheat (haura).	Embanked-dung (160 mds. per acre)	1,196	1,354	+49	+32	14 8 0	Nil.	5 8 6	41 0 2	
		43	A.	0·35		do. no manure.	804	1,029	...		Nil.		7 13 6	28 0 0	
21	To test the effect of embankments which keep the field full of water with embankments which keep the field partly covered, with manure.	41	A.	0·303	Wheat (haura).	Embanked-dung (160 mds. per acre)	1,196	1,354	+72	+20	14 8 0	Nil.	5 8 6	41 0 2	41B did not hold water properly.
		41	B.	0·318		do. do.	693	877			14 8 0		9 8 3	24 1 5	

22	To test the effect of embankments which keep the field full of water with embankments which keep the field partly covered, without manure.	43 43	A. B.	0·35 0·358	Wheat (haura).	Embanked —Nil. do. —Nil.	804 341	1,029 612	+135 ...	+68 ...	Nil.	Nil.	7 13 6 7 10 8	28 0 0 12 8 8	43B did not hold water properly.
23	To test the effect of embanked against unembanked field, with manure.	41 18	A. 4	0·309 0·23	Wheat (haura).	Embanked-dung (160 mds. per acre) Unembanked do.	1,186 837	1,354 1,029	+43 ...	+32 ...	14 8 0 13 12 12	Nil.	5 8 3 13 10 10	41 0 2 31 0 11	
24	To test the effect of embanked against unembanked field, without manure.	43 18	A. 2	0·35 0·26	Wheat (haura).	Embanked, no manure Unembanked do.	804 612	1,029 832	+31 ...	+7 ...	Nil.	Nil.	7 13 6 14 5 5	23 0 0 25 3 7	
25	To test the effect of mixing gram with wheat.	25 ...	1 2	0·21 0·21	Wheat (haura). ... do. and gram ..	Nil. Wheat. Gram.	704 473 732	978 671 892	... ...	... ...	Nil.	Nil.	13 9 7 13 1 11	24 12 10 27 11 6	
26	To test the effect of deep tillage.	21	1 2 3	0·22 0·23 0·23	Wheat (pissi).	Soil ploughed and bakhared (bullock hoed.) Soil bakhared only Soil ploughed and bakhared	616 731 740	1,327 1,416 1,090	—16 ... +1	— 8 ... —74	Nil.	Nil.	13 6 2 12 15 3 13 14 1	23 10 1 23 7 3 26 5 3	This plot is to be ploughed every year. This is not to be ploughed at all. This is to be ploughed every third year.
27	To test the effect of thick *versus* thin sowing.	40	1*a* 1*b* 2*a* 2*b*	0·06 0·06 0·06 0·06	Wheat (haura).	55lbs. seed sown per acre .. 80lbs. do. .. 108lbs. do. .. 125lbs. do. ..	812 654 883 760	1,420 1,845 2,433 2,086	... —20 +9 —6	... +50 +71 +46	Nil.	Nil.	12 3 10 32 13 2 15 7 2 15 7 2	29 11 9 26 9 8 35 11 3 20 12 3	Plot 1 is the standard plot, the sowings made on the Farm being generally at the rate of 60 lbs. per acre.
28	To test the effect of seed selection.	39	1 2	0·28 0·26	Wheat (haura) pedigree selected seed. Do. ordinary seed	Dung (160 mds. per acre) .. Do. ..	770 922	1,358 1,664	—17 ...	—43 ...	13 8 7 18 10 0	Nil. ...	12 10 1 12 12 2	23 3 3 32 13 3	

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Annexure E.—(Concluded).

Serial No.	Object of experiment.	No. of field.	Sub-plot.	Area of sub-plot.	Crop grown.	Special treatment.	Outturn per acre.		Percentage of increase + or decrease(—) in produce resulting from experimental treatment.		Cost per acre.			Value of produce per acre.	Remarks.
							Seed or Grain.	Straw.	Seed or Grain.	Straw.	Manure.	Special treatment.	Cost of cultivation excluding manure and special treatment.		
				Acres.		(C.) *Wheat*—(Concld.)	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
29	To test the effect of seed selection.	61	1	0·33	Wheat (haura) pedigree seed.	Nil.	764	1,275	+13	+8	Nil.	Nil.	14 14 3	24 14 2	
			2	0·33	Do. ordinary		677	1,198	...	...			14 11 1	22 4 11	
			3	0·33	Do. pedigree seed		600	990	—11	—17			14 2 6	19 8 0	
30	To raise improved seed by selection and high cultivation.	1	A.	0·032	Wheat (haura)	Dung, 160 maunds per acre	992	2,317	...	...	The cost of cultivation is not given as this experiment has no bearing on profit or loss.		...	...	Irrigated thrice.
			B.	0·033			1,100	3,158	...	...			...	...	Do. twice.
			C.	0·032	Wheat (pissi)	Do. do.	1,092	3,175	...	...			...	...	Do. thrice.
			D.	0·032			825	2,975	...	...			...	...	Do. twice.
		1	E.	0·032	Wheat (katha)	Do. do.	1,008	2,400	...	...			...	...	Do. thrice.
			F.	0·032			1,025	2,550	...	...			...	...	Do. twice.
31	To test the effect of rotation ..	29	1	0·29	Wheat (haura)	Nil	604	1,134	...	...	Nil.	Nil.	8 5 7	24 4 9	
			2	0·29			515	1,102	...	...			7 14 9	21 3 8	
			3	0·29			537	1,086	...	...			8 0 2	21 13 2	
			4	0·29			539	1,037	...	...			7 9 10	21 15 7	
						(D.) *Linseed.*									
32	To test the effect of stall dung and box dung.	63	1	0·32	Linseed (haura)	Box dung (160 mds. per acre)	235	674	—19	—14	Nil.	Nil.	9 8 10	14 11 9	
			2	0·32		Nil.	291	781	...	...			11 5 11	17 15 7	
			3	0·32		Stall dung (160 mds. do.)	363	935	+24	+20			10 6 4	21 15 8	
33	To test the effect of rotations ...	57	1	0·28	Linseed (haura)	Nil.	129	288	...	...	Nil.	Nil.	7 11 6	8 2 10	
			2	0·28			62	210	...	...			7 14 6	5 0 9	
			3	0·28			31	230	...	...			3 5 11	5 5 9	
			4	0·28			99	302	...	...			8 3 3	3 7 2	
34	To test the comparative yield of different varieties.	55	1	0·29	Linseed (haura)	Nil.	443	949	+22	+40	Nil.	Nil	10 1 2	26 2 6	
			2	0·287			460	1,093					9 10 5	27 11 3	
			3	0·283			409	925					10 5 2	24 6 4	
			4	0·279	Linseed (katha)		462	1,042	...	...			10 7 3	24 13 3	
			5	0·275			411	929	...	...			10 0 7	22 1 6	